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German Practice in Surface Designation

The mechanical limits of machinery and parts have long been the subject of precise specification. Until recently finish was considered of secondary importance and in most instances left largely to the judgment of those in the operating department. There is now a growing conviction that the designation of surface finish is an engineering function and that some standard should be devised for the purpose. A timely review of the German national standard is therefore in order

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INCREASING interest has been shown during the last few years in the establishment of a standard method of indicating on drawings the nature of the surface of workpieces. The purpose is to convey complete information to the production department as to whether the surfaces should be left rough or be given a finish, and in the latter case, the character of this finish.

In addition to finishes produced by metal-removing processes, others, such as painting, enameling, and electroplating, must sometimes be specified. An analysis of the general problem shows that quite a number of items have to be considered, and the setting up of a standard system of surface designations is therefore rather an elaborate task. A start in this direction has been made by sectional committee Z14 on drawings and drafting room practice organized in 1926 under the procedure of the American Standards Association. (Sponsored by the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education).

Work on the subject has also been undertaken by a technical committee on drawings organized under the auspices of the International Standards Association. (The ISA is a federation of eighteen national standardizing bodies including the American Standards Association. Its main purpose is to avoid or eliminate unessential differences between national standards). In May, 1931, this committee held a meeting in Copenhagen, Denmark, where the German national standardizing body submitted the latest revision of its own national standard, a complete and thorough piece of work, for consideration for international usage. This development is of interest in this country, particularly as many inquiries on the subject have been received by the American Standards Association in the last few years.

As fundamental in regard to the designation of surface finishes, mention should be made here of the work to be undertaken by a committee now being organized under the procedure of the American Standards Association to

Smoothness	Accuracy of shape	Representation of surfaces
imperfect	imperfect	
imperfect	good	
good	imperfect	
good	good	

Table I—The German standard gives the above table listing the four possible combinations of accuracy of shape and smoothness of surface. This serves to visualize the difference in concept between these two factors

establish a standard classification of surfaces according to their quality. When this has been done, a specific machine finish may be indicated on a drawing by a symbol or quality number, in the same way as this is done for a standardized screw thread or fit. However, only the question of surface designation on drawings rather than the more fundamental question of surface classification is dealt with in the German standard. The scope of this article is therefore restricted to this subject.

The German standard (DIN 140 (six sheets), published in revised form in October, 1931) is based on the consideration that the drawing of a workpiece must indicate the nature, and if necessary, the quality of its surface as required either by the functioning of the workpiece when assembled or merely by its appearance. This indicates a tendency toward greater completeness and explicitness of the drawing. A similar tendency exists where fits are specified on the drawings by the manufacturing limits for the mating parts instead of leaving the establishment of the correct fits to the production department. Modern manufacturing methods demand that the workshop receive complete and clear instructions. It is the duty of the engineering department to issue only such instructions as can be carried out with the production equipment available. This condition can be reached only by due cooperation between the engineering and production departments.

Three Classifications

Surfaces are classified by the German standard into three groups: (1) rough, (2) finished, and (3) treated. The term "finished" applies to any surface from which metal has been removed either by hand, such as filing, or by mechanical means, such as turning or grinding. By "treating" a surface, the Germans mean its being subjected not only to heat-treatment but to any treatment other than a metal-removing process. Electroplated, painted, varnished, or zinc-coated surfaces are thus comprised in the group of "treated" surfaces, as well as case-hardened surfaces, for example.

The three main classes are described and subdivided as follows:

1. *Rough Surfaces.*

(*a*) Surfaces of workpieces produced by the most commonly used processes, such as rolling, forging, casting, autogenous cutting, may be permitted to conserve the relative natural roughness resulting from these processes.

(*b*) In other cases, the surfaces, although permitted to remain rough—that is, requiring no special finish by means of a metal-removing process—must be of a better quality than would result from the ordinary production processes mentioned under *a*. Such surfaces may be obtained by more refined production processes, such as for example smoothing in a die, or by specially accurate forging, casting, or autogenous cutting.

(*c*) Sometimes, a surface produced by a more refined process as referred to under *b* still shows certain unavoidable, but nevertheless non-permissible defects requiring local correction, for example by grinding or filing. In this connection, the German standard explicitly states that the removal of fins from castings, as taken care of in the foundry, does not come under this heading.

2. *Finished Surfaces.*

If the surface of a workpiece must be of a higher quality than that obtainable with any of the processes mentioned under Class 1, it must be given a special finish. Distinction is made between two subgroups of finishes as follows:

(*a*) Plain finishes, consisting in metal-removing processes, such as turning, boring, milling, planing, grinding, and filing. The difference in quality of finish resulting from these various processes will be dealt with later.

(*b*) Special finishes, that is metal-removing processes intended to produce a high quality of surface, or to impart a particular character to a surface that has already been given one of the plain finishes referred to under *2a*. Such special finishes are for example: lapping, honing, scraping, polishing.

3. *Treated Surfaces.*

Certain surfaces, whether rough or finished, require a "treatment" usually having for its purpose a change in the properties of the material (hardening, annealing); or protection of the surface against corrosion (electroplating, painting); or again, improvement of the appearance of the surface (polishing).

For each of the above three main classes and also for the subgroups *2a* and *2b*, a standard method of indicating the nature of the surface is given in the German standard. Before proceeding to the listing of these methods, the standard explains that the quality of the surface finish of a part, and its quality as to accuracy of shape, are two different things. Accuracy of shape is dependent on the

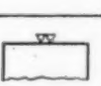
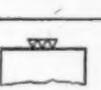
Surfaces with a quality of finish obtainable, without removing metal, by means of ordinary production methods, (rolling, forging, drawing, pressing, autogenous cutting, casting	No excess material to be left for finishing process.	
Surfaces with a quality of finish obtainable, without removing metal, by means of more accurate production methods (accurate forging, smoothing in a die, accurate casting, accurate autogenous cutting. Surfaces are machined only if requirements are not met by the processes in question		
Surfaces with a quality of finish obtainable for example by means of a rough finish metal removing process, applied once or several times. Tool marks may be tangible and clearly visible to the naked eye	Excess material to be left for finishing process. The amount is to be specified separately, for example in the instructions given to the shop.	
Surfaces with a quality of finish obtainable for example by means of a medium-finish metal removing process, applied once or several times. Tool marks may still be visible to the naked eye		
Surfaces with a quality of finish obtainable for example by means of a high-finish metal removing process applied once or several times. No tool marks should be visible to the naked eye		

Table II—Rough surfaces (Class 1) and plain finishes (Class 2a) are designated by symbols. The "approximate" sign derives its name from the fact that it has been standardized in Germany as a symbol indicating that two values are approximately equal, for example, one inch ~ 25.4 millimeters (the accurate figure being 25.40005)

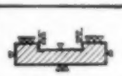
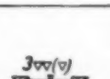
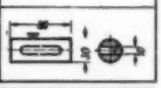
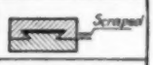
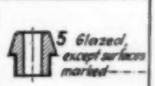
manufacturing limits between which a part is held. For a cylindrical part, this concerns the diameter as well as out-of-roundness and straightness. Quality of surface finish depends on the size, the frequency, and the distribution of the minute unevennesses by which the surface deviates from an ideally smooth surface. Generally speaking, quality of surface may be said to be identical with smoothness. This is not entirely true, but this question cannot be dealt with in detail here.

Both characteristics of a surface, accuracy of shape and smoothness, are permitted to vary to a certain extent depending on the nature of the function which the workpiece has to fulfill. In the absence of a standard classification, quality of surface has sometimes been specified by reference to a series of samples, each representing a certain degree of coarseness or smoothness, serving as a guide in manufacturing the product.

The German surface designations may be divided into two groups. One group applies to surfaces classified under item (1) rough surfaces, and (*2a*) plain finishes. The second group comprises designations for surfaces classified under item (*2b*) special finishes, and (3) treated surfaces.

The former group of designations is listed in Table II. According to the German standard, they are meant to be used on the drawings to indicate the character of the surface, but not any specific finishing process to be used for obtaining the surface in question. If, therefore, the workshop for some reason wishes to produce a certain

Table III—In addition to the main rules for indicating the nature of work pieces, the German standard includes series of examples of practical applications. These examples give certain additional rules to be observed

1	Surface symbols should normally refer to the lines representing the surfaces concerned. If space does not permit this, they should refer to auxiliary lines forming extensions of the surface lines	
2	For a surface of revolution, such as a cylinder or a cone, the symbol should refer to one generating line only	
3	If all surfaces of a workpiece are of the same nature, the surface symbol should be placed after the part number or near the sketch of the workpiece. In this case the surface symbol should be made larger than those referring in the normal way to surface lines, in order to stand out more clearly	
4	If most of the surfaces of a workpiece are of the same nature, the corresponding symbol may be placed after the part number or near the sketch of the workpiece (as in Example 3), the symbol for the surface that forms the exception being added in parentheses. The latter symbol should be added also to the surface lines concerned. The same method may be applied in cases where two different symbols are used for surfaces forming exceptions	
5	If a part is represented in more than one section or view, the surface symbols should be inserted only in that section or view where the dimensions are given	
6	If two parts represented in assembled condition have the same kind of surface, the symbol should be inserted only once	
7	If only part of a surface is required to have a specific quality or is to be subjected to a specific treatment, this should be indicated by means of a dimension line (either with or without a dimension figure) placed closely to the surface symbol. If necessary, a dimension figure should be placed closely to the symbol	
8	Surface symbols referring to gear tooth flanks that are not shown in the drawing (because of diagrammatic representation of the gears) should refer to the pitch circle, either in the side view of the gear or in its cross-section. For small sketches of gears, the symbols may be accompained by leaders	
9	If a ceramic product requires the same surface treatment throughout, with the exception of a few surfaces that are not to be treated, the latter surfaces may be indicated by dot-and-dash lines. An explanation should then be added to the part number or placed closely to the sketch of the product	

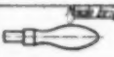
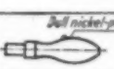
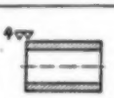
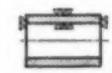
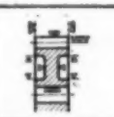
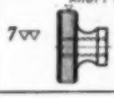
	Surface Requirements	Process	Workpiece
10	Accurate and smooth	Cold drawn	
11	Accurate and smooth	Medium finish, turned or ground	
12	Very accurate and smooth	High finish, turned or ground	
13	Free of coarse unevennesses	Malleable iron casting; imperfections removed if necessary	
14	Smooth surface; no particular requirements as to accuracy	Die-forged and made bright	
15	Accurate and smooth	Turned from a forging or from the solid, medium finish	
16	Accurate and polished	Turned from a forging or from the solid, medium finish, and polished	
17	No particular requirements as to accuracy. Dull nickel-plated	Die-forged, beaten bright, and dull nickel-plated	
18	Surfaces cylindrical and plane, respectively, and smooth	Outside and end faces: medium finish, turned or ground. Hole: medium finish, bored or reamed	
19	Very accurate and smooth, except the end faces which require a smooth finish only	End faces: medium finish, turned. Outside and inside surfaces: high finish, turned, reamed, or ground.	
20	Very accurate and very smooth, except the end faces which are only to receive a smooth finish	End faces: medium finish, turned. Outside surface: high finish, turned or ground, followed by lapping. Hole bored, ground, and honed.	
21	Tooth flanks free of coarse unevennesses. Bore cylindrical and smooth. All other surfaces to remain rough.	Cast. Teeth, if necessary, freed of unevennesses by filing or grinding. Hole: medium finish bored or ground	
22	Bore accurately cylindrical and very smooth. All other surfaces to be given a smooth finish. Surface of recesses remains rough.	Gear cast or pressed. All surfaces medium finish, except recesses. Hole: high finish, bored or reamed	
23	All surfaces rather accurate and smooth. Tooth flanks and bore to be very accurate and smooth	All surfaces of gear turned. Recesses rough-turned. All other surfaces: medium and high finish, respectively. Tooth flanks ground.	
24	All surfaces to have a smooth finish. Rim to have a certain roughness as obtained by knurling, in the present example with a pitch of 0.6 mm	All surfaces medium finish, turned. Rim knurled	
25	Smooth, white enameled surfaces	Sheet metal cup drawn. Surfaces cleaned (pickled and dried) and enameled	

Table IV—For each of the workpieces, the requirements for the quality of finish for one or more surfaces are listed, together with the mention of the process by which this finish may be produced, and the standard method of designation. Incidentally, several of the workpieces represented would require more than one surface designation on the drawing, but for the sake of simplicity, only one surface quality has been selected in each illustration

quality of finish by grinding instead of by reaming, it is left free to do so. Also, the finishing processes given in Table II—such as rolling and forging—are meant merely as guides to quality of surfaces, not as definite instructions.

In reference to the surface symbols in Table II, the German standard states that each of these applies to a certain range of surface qualities. Within this range, the surface quality will vary somewhat, depending on the

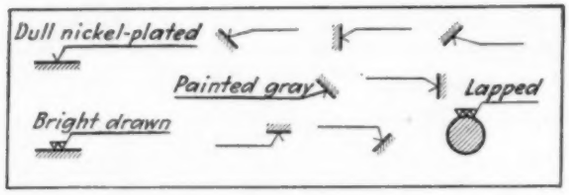


Fig. 1—Finishes other than rough or plain machine are designated by lettering the name of the finish and indicating by a leader the surface affected

nature of the finishing process, the material of the workpiece and its dimensions. In other words, there are supposed to be two "limits" of surface quality between which the actual surface quality of the workpiece must lie, just as the actual size of the workpiece must lie between two manufacturing limits. Evidently, the surface quality of the workpiece indicated by the symbol must be at least equal to the lowest "limit of quality".

In this connection, it should be observed that in so far as there does not yet exist a standard basis of measurement for the quality of a surface, recourse must be taken to physical samples of surface finishes: rough, turned, ground, lapped. In making up such samples, it may be feasible to establish one sample representing the "high limit," and another sample representing the "low limit" of quality. However, the practice so far has been rather to establish a number of nominal surface finishes with which the surfaces of the workpieces concerned must be practically identical, or which they must at least approximate with reasonable closeness.* There remains an element of personal judgment in the use of a classification scheme of this kind, but so far it has been the best that could be done. It is expected that the situation will eventually be improved by the work of the new sectional committee.

Surfaces requiring a higher quality of finish than those obtained by "plain" machining (Class *2b*), and those requiring a "treatment" other than a machine finish (Class 3), are not accompanied by a symbol on the drawing, but by the term indicating the finish, written out in full.** The designation by name of such a finish is added to the symbol designating the plain finish (see Fig. 1). The German standard recommends that each manufacturing concern establish a list of all terms used in its production methods, illustrated by practical examples. To this, the writer would add that many such terms are suitable for a general standardization and therefore might well be incorporated into a national standard so as to give the maximum degree of mutual understanding.

For the sake of easy reading, the German standard specifies that a word designation of a surface finish should be written in the horizontal direction above the "leader," independent of the position of the surface to which the symbol refers. In case the word designation is added to a surface symbol, the "leader" should terminate in the symbol (Fig. 1).

Word designations of surface finishes should refer to the nature of the finish, and not to the process by which the finish is obtained. This principle has been adopted to leave the manufacturer the greatest possible liberty in the method of producing a surface of a specified quality. For example, if a lapped surface is specified on the drawing and the workshop should be in a position to produce an equivalent surface by some other means—say by applying a newly invented process—it is permitted to apply this alternative method, according to the German standard. Similarly, the general word designation "painted gray," for example, leaves the workshop free to apply the paint either by means of a brush or by spraying or dipping.

The German standard also deals with the question of auxiliary processes, that is, processes which either may or must be carried out in order to obtain the finish specified by the word designation. If such an auxiliary process is a necessary part of the general method of applying the finish, it should not be mentioned. Thus, the cleaning of the workpiece before it is electroplated, or its being dried after this treatment, are not recorded on the drawing. On the other hand, if a surface must be stained before being painted, this fact should be mentioned on the drawing, as painting is not necessarily preceded by staining in all cases.

*See also "Standards for Surface Finishes," by S. M. Ransome (*AM*—Vol. 74, page 581) and "Standardization of Machining Finishes," by R. C. Deale, (*Mechanical Engineering*—Vol. 53, page 723).

**The German standard mentions that the method of word designation in combination with "leaders" may also be applied for indicating such methods of connecting parts as cannot be shown on the drawing (glueing, soldering, shrinking); for indicating methods of making tight connections (caulking, filling with lead); or for indications applying to the method of assembly (drill when assembled, rivet during erection). However, designations of this kind have no bearing on surface quality.

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Early Semi-Steel

ROBERT E. MASTERS

A GOOD DEAL is being said about the early melting of scrap steel in a cupola. *The Foundry*, Dec. 15, 1922, which refers to *AM* of 1884, gives a complete account of the first melting of all steel scrap without any cast iron in it whatever. I have made castings up to 20,000 lb. each with up to 40 per cent scrap steel in the mixture, long before and since, and I expect it had been done for a hundred years before that time. But as Thomas D. West wrote in *AM* he had never heard of an all-steel heat from a foundry cupola being undertaken until reading in the *AM* of my accomplishing it.

There had been a good deal of bladge about it in the local papers, and the day I set to undertake a heat of 2,000 lb. of all steel alone, quite a batch of pencil shovers came to see it, headed by Henry Grady, then well known Editor of the *Atlanta Constitution*, with his famous slogan: "The New South." Well the heat was a success and the reporters broadcast it all over the world and then some, judging from the barrel of letters I received.

I took off a number of 4,000-lb. heats of all steel alone. We found it gave good service for furnace liners, back plates, grate bars, brake shoes, rail braces, and such castings. The cupola bottom dropped fine and left the cupola and ladles cleaner than cast iron does.

NEW BOOKS

WORKING FOR THE SOVIETS. An American Engineer in Russia—*By Walter Arnold Rukeyser. 286 pages, 5½x7½ in. Cloth board covers. Illustrated. Published by Covici-Friede, 386 Fourth Avenue, New York, N. Y. Price $3.00.*

Devoid of sweeping generalities and concerned only with the straightforward relation of what happened, this book tells the story of an American engineer's experiences as consultant to the asbestos trust of the U.S.S.R. Mr. Rukeyser served the Soviets at the start of the five-year plan in 1929 and again in 1930-31. This double exposure to the communist experiment enabled him to make certain comparisons which give depth to his picture of conditions in Russia.

The author confines himself to facts and for the most part leaves interpretation to the reader. The difficulties of travel, the peculiar and not-altogether-pleasant position in which the American consultant finds himself, his relationship to his employers and to the native engineers with whom he must work, the problems of food, cigarettes, housing, and money, the activities of the GPU, and the conditions of the workers both in 1929 and on his subsequent visit are recounted in a style so simple yet vivid that the reader almost believes he has himself just returned from the world's most talked-of country.

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PSYCHOLOGY AT WORK—*Edited by Paul S. Achilles. 260 pages, 5⅝x8⅝ in. Cloth board covers. Illustrated. Indexed. Published by Whittlesey House, the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price $2.50.*

Seven leading psychologists in as many divisions of the field contribute each a chapter. The chapters are headed: Psychology and the Pre-school Child; The Study and Guidance of Infant Behavior; Psychology and Education; The Foundations of Personality; Psychology and the Professions, Medicine, Law, and Theology; Psychology and Industry; and Psychology in Relation to Social and Political Problems.

That chapter which deals with psychology in industry is concerned mostly with accident proneness and the selection of individuals to fill certain positions. The book makes no attempt to be a complete treatise on psychology but is rather designed to show in a series of brief sketches the work psychologists are doing.

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GENERAL ENGINEERING HANDBOOK—*Edited by Charles Edward O'Rourke, Cornell University. 921 pages, 5x8 in. Indexed, illustrated and diagrammed. Flexible clothboard covers. Published by the McGraw-Hill Book Company, Inc., 330 West 42nd St., New York, N. Y. Price $4.00.*

In the belief that engineers in one field need for daily use a pocket handbook of salient information in associated fields, this volume was prepared. Included are 31 subdivisions, each dealing with one general subject. Six sections contain material of interest to all engineers, eleven belong primarily in the field of civil engineering, nine in mechanical engineering and five in electrical engineering.

Many shop libraries are limited almost entirely to works on machine-shop practice and mechanical engineering. Consequently, when any subject comes up in an associated field, much searching and borrowing of books becomes necessary. The book under review avoids this need, however, for it presents concisely, yet completely, those elements of information most often needed. Sensibly, it avoids explaining the derivation of formulas, assumes a general knowledge of the field and prior experience with tables and graphs. Other similar steps shorten the individual topic and allow a more complete and extensive compilation of data.

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HANDBOOK OF BUSINESS ADMINISTRATION—*By W. J. Donald, Managing Director, American Management Association. 1753 pages 4½x7 in. Bound in leather. Indexed. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. Price $7.00.*

As business increases in complexity, the ramifications of management become at once wider and more intricate. Especially in large corporations, which now include such a large portion of our total business activity, executive functions demand the services of specialists.

This handbook affords for the first time a medium wherein functional executives may find advance practices in their own field and at the same time familiarize themselves with those in parallel fields. It provides a reference for chief executives who have the tremendous task of coordinating the many-sided administrative effort loosely classed under the term management.

Mr. Donald has collected a wealth of diversified material. This has been abstracted from papers presented before the American Management Association, supplemented by independent contributions. The material represents the work of some 140 contributors.

For convenience as a reference, the book is divided into six sections: marketing, financial management, production management, office management, personnel management, and general management. Each section is in reality a complete handbook in itself. Whether the immediate problem is plant layout or sales promotion, purchasing or employee training, it will be found treated fully.

Within the past year or two there has been a modification in the understanding of business. It is now realized that its purpose is not only to make profits for its owners. The interests of its employees and consumers of its products must be considered. The wide economic aspects of a going concern cannot be ignored.

The handbook should find use in promoting a broader view of management as well as providing a timely aid in meeting problems of the moment. For both reference and thorough reading, executives will find it a unique and valuable addition to their libraries.

The FOREMAN'S ROUND TABLE

Tools a la Carte

"HOWDY, AL," said Ed as he barged into his friend's office. "Say, I've got a little government job on this reel. Can you do it for me? No hurry. Any time before the fishing season opens."

"Sure, Ed. Glad to. I don't mind doing work for someone else that I wouldn't do for myself."

"That's what Williams said. He suggested that if foremen would exchange work it wouldn't cause so much comment. I guess he's right at that."

"Sure he is, and there's another angle to it. If some other department does it there won't be as much government work done. I'm not hitting at you, Ed, I'm merely stating a fact."

"Mebbe you're right, Al. And say, hear the latest? Williams called 'Brick' Jessup into his office. When he came out, poor Brick was so fuddled that all he could remember was that Williams was going to do away with the tool makers. Know anything about it?"

"Brick has the wrong slant. As I remember it, Williams intends to do away with the machine hands in the tool room, not the toolmakers."

"Ain't they toolmakers too?"

"Ours are, maybe, but in many toolrooms they are machine-tool operators getting toolmakers' pay."

"How come they are machine operators now? When I was a toolmaker, I started a tool by picking some junk out of the scrap heap and I did every bit of the work, down to making the dowel pins. A die-maker wouldn't think of letting anyone else touch his job."

"Sure, I used to think so too, but as I look back on it I can see that some of it was bunk."

"What do you mean, bunk?"

"I mean this. We didn't do as close work then as we do now."

"Is that so? Let me tell you, feller, we made some pretty nice tools in those days. We worked as close as toolmakers do now and had nothing to do it with."

"Sure you did, Ed. I'm not belittling the work you did, but you got good work by making one part, and fitting the mating parts to it."

"Sure we did. It was the best way. Why shouldn't it be done that way now?"

"We can't afford to."

"There's darn little difference in the cost, I bet."

"I didn't mean cost, I meant in reputation. Having a tool room nowadays hurts your reputation, it seems."

"That's a crazy idea. How can you get along without toolmakers? Who's going to make tools and dies?"

"Sure we must have tool and die-makers, and good ones too. We specialize in good work, and nothing in the way of close work fazes us. Williams was boasting about this to a prospective customer the other day. This guy knew what grows from onion seed, and he asked Williams about his toolroom. Williams went on to tell about the good men and machines he had in it. When he was all through, the man said 'If you do as close work in the shop as you claim, why do you need different men and machines to make parts for tools and dies?' Williams says he was flabbergasted for a moment, then he said to the customer, 'Good idea! You give me that order and I'll send every darn tool part through the shop as regular product, and I'll give you the benefit of any savings I make.' And he got the order, too."

"Yeah! And he got a darn poor idea along with it."

If the shop can work as close as the toolroom is there any necessity for both? Does it add to the prestige of a shop to eliminate the machine part of the toolroom? Are the economies enough to justify it?

Discussions

The Outsider

Many times, the argument put up by Al against the outsider is warranted. He may have experienced some changes made by so-called efficiency engineers, who were no more than egotistical machinists with little if any knowledge of the fundamentals of industrial management and engineering. This type is soon recognized and released, but the agitation caused in the minds of the workmen is not soon forgotten. An incident such as this should not condemn all consulting engineers.

There never was a time when industry needed the guidance of good consulting engineers more than it does today. Closer analysis is needed to cut costs on present production, thereby preparing the way for a great business revival.

—Edward E. White,
The Cincinnati Bickford Tool Co.

Till It Hurts

Compulsory action for charity is not justifiable, and is an imposition on the good nature of the average person. The only exception is in the action of a city, state, or federal authority, by which the burden is equitably divided amongst all, as taxes. The public-spirited citizen or community driver is usually actuated by commercial, or selfish motives of publicity. He points with pride to himself as giving a pledge for a large amount, or a day's pay like everyone else. The proportion is something like the 50-50 of the colored man who made the Brunswick stew of one mule and one rabbit, as a day's pay of a man with a $10,000 income is not on a par with a man making $10.00 a week, some weeks.

It is a hard problem to make an even distribution of the burden of caring for others, and the way to do it is not to make the other workers pay an arbitrary figure, but through proportionate taxation. Some people will escape under any system, and this is to be expected, as people even make false income tax returns.

Government methods are usually more businesslike and just than those proposed at public gatherings, where feelings are played upon and vanities appealed to, by experts with whom the organization of these affairs is a racket. Until some fair method, under which all will contribute is found, I think the best so far, is the provision of work for all who are unemployed, by city, state, or federal authority, which is not charity, as some return is given in the form of labor.

—John S. Isdale.

On the Spot

A shop foreman receives requests of a largely varying nature, all calling upon his powers of discretion and discrimination. By using the powers which become second nature to him, he is able to judge as to how he shall answer them.

In the case of requests asking for his presence in one of the office departments, the nature of the business should be stated. The foreman is then in a position to judge whether the business is of sufficient importantance to warrant the journey.

If the request comes to the foreman from a superior, of course, he must make the journey without any question, but if it is from some equal or an inferior the foreman should inform that person that he cannot leave his department. Usually one refusal is quite sufficient to create a precedent for the future. Most foremen realize that their place is in their own department, and the wise ones never encroach on another's province.

If a deadlock arises by the foreman refusing to attend or to give the information requested, the office head should make a complaint to the powers above and obtain a definite ruling. If however all departments use discretion and discrimination, there will be no need for any higher appeal.

—W. H. Rhodes.
Birmingham, England.

How Much Economics?

About ten years ago all the jobs of the foremen were taken away (except to get production) and given to other departments such as planning, employment, material control, rates, and tools. All his thinking was done for him, and he was told to run the job as scheduled and not to ask questions. Such items of overhead as floor space, light, heat, taxes, supplies were regulated by management, and the foreman only needed to keep his men busy.

But the management now realizes that it has not given the foreman as broad a training as he should have if he is to operate his department and make a better product at a lower cost. Costs are often complicated, and slight changes can frequently raise or lower the cost a considerable amount. The foreman must know the steps in building up the costs and what items he can control. The subject of economics enters in—how the law of supply and demand regulates the selling price and directly determines what the cost must be in the shop if the article is to sell. What is the law of diminishing returns—are there any jobs in the shop where increased production would not decrease costs?

But looked at another way, most foremen should be glad to be studying something during these days of quiet production, just to get his mind off the depression. Fill the mind with constructive thoughts and not with depressing ideas.

—Edw. H. Tingley, *Secretary, National Association of Foremen.*

Traffic Congestion

The habitual breaking up of lots or operations is usually the result of poor planning. The planning may be done by a poorly conducted office or follow the changes of mind of some executive.

A sample of this last mentioned condition, as it worked out in a fair sized jobbing shop, was recently observed. The superintendent controlled production on a basis of satisfying the customer who pressed the hardest or made the most noise. The morning mail usually meant several changes as to what was the most urgent, and a telegram always meant a new set-up if the parts in question were not already being worked on.

The collection of data regarding breaking up of operations is of little value if it is not used to reduce the evil. It is difficult to prove that a few given cases were not necessary, if the cost, for example, happens to be too high. The sending in of reports would act as a deterrent for a short time, but if no pressure is brought, they will be of no value.

—L. F. Swenson.

Fig. 1 — Irritating mechanical protection for operators' fingers is avoided by the application of electronics to the punch press. Interrupting a beam of light in the path of the ram is sufficient to prevent operation

Photocells in the Shop

DR. IRVING SAXL
Consulting Physicist

Bringing in broadcast programs is not the sole function of the radio tube. Metal-working plants have discovered many new uses for it with every indication of more to come

LIGHT-SENSITIVE devices and photocells, primarily designed for the radio and related industries, have found a field in the shop. They control and test automatically machines and plants, they safeguard operators, they count, measure, and record. Many industrial processes have already been improved and a still greater number can adopt photoelectric control to advantage.

Take for instance light-sensitive cells controlling the operation of a punch press. Ordinarily safeguarding a punch press is difficult. Mechanical safeguards irritate the worker often to the extent that he removes them purposely. The worker is interested to produce with the least effort. He would rather risk his fingers than slow down his production. He sees only the present obstruction to his task and not the result of an accident.

Compare this to the device shown in Fig. 1. At the left side is a dark box with two lighted holes. From the upper opening, a concentrated beam of light is directed so that it just passes the piston of the punch press. At the opposite side, the light rays are reflected from a boxed mirror, the back of which may be seen at the right of the picture. The beam of light travels back, and after having again passed the piston, enters the photocell in the lower hole.

Anything in the way of either of the light beams, for instance the hand of the operator, would intercept the illumination of the photocell. Changes in the photocurrent operate a relay which controls the movement of the press, preventing its operation as long as the hand is in the field of danger. As soon as the hand or the obstructing object is drawn back, the light is allowed to pass, the photocell is illuminated, and the ram is given free movement.

In Fig. 2, a schematic diagram is given for the control of power processes with the aid of photocells. A beam of light is produced by an incandescent lamp. After being concentrated by a reflector and a lens, the light rays pass through the area which has to be safeguarded.

Instead of reflecting the beam of light only once, it is possible to throw it back and forth a number of times. The light can therefore cover a wide area by

using a series of mirrors so that the light ray may travel over any path desired. By using repeated reflections, it is possible to make an actual screen of light. Any objects brought within that light wall interrupt the beam. This is an excellent means for controlling the field around various objects.

By using a certain type of photocell, susceptible also to the infra-red invisible part of the spectrum, it is possible to make the entire control invisible. No object brought into this path of heat rays would be illuminated or cast a shadow. Such walls of black light can be used advantageously for protection against theft. The objects protected remain plainly visible and are still under full control.

A device of this type was exhibited at the Colonial Exposition in Paris. A reward was promised to anybody who could take an object from a case without ringing an alarm. Although no visible contact was interrupted, the alarm rang immediately if a hand was brought near the object. It is possible to produce a similar effect with the aid of certain high sensitive radio tubes which react upon small changes in the electric capacity of nearby objects.

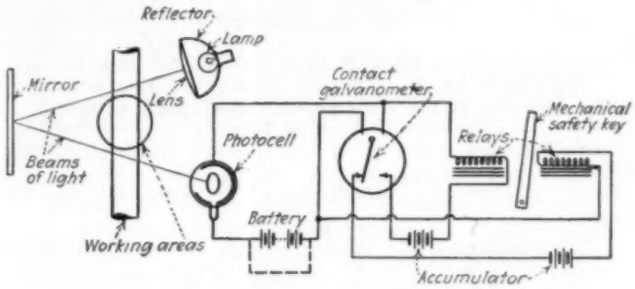


Fig. 2—Many circuits may be employed with the device shown in Fig. 1. The above is simple and typical

The photoelectronic cell does not give sufficient energy to operate a power device directly. For this purpose, the minute current controlled by the photocell must be amplified. This current increase is usually done in several stages. It is possible to use electromechanical relays or electronic tubes (vacuum tubes or gas-filled) for this purpose.

From the many circuits which are practical, only a few may be shown. The fundamental and principal circuits may be used with variations for the solution of many special problems.

In Fig. 2 a purely mechanical circuit is shown. This photocell operates first one of the most sensitive relays known which is called a contact galvanometer. This electric relay, however, is built strong enough to close or open one or two switches in a circuit which has a separate battery and is able to control a power switch and circuit.

In the case illustrated the contact galvanometer has closed the contact to the left side, so that the current is allowed to flow over the right relay which is fed from the storage battery. The safety key will be attracted by the electromagnet and moved to the right. If, however, the beam of light is interrupted, the contact galvanometer will strike the contact at the right side, the relay current will be switched the other way, and the key will be moved toward the other electromagnet. By making the safety key fit into a hole in the ram operation of the press may be prevented. Another way is to shut off the power supply for the machine if the light rays are obstructed. Instead of mechanical amplification as shown in the galvanometer relay of Fig. 2, it is possible to use tube amplification as sketched diagrammatically in Fig. 3. The wiring of the power part of the primary circuit is analogous to the wiring in Fig. 2. There is, however, in Fig. 3 one detail which may be used advantageously for various tests although it is possible to operate a photocell without it.

Putting Instruments to Work

This is the application of the moving pointer or the mirror of an indicating instrument, for instance a galvanometer, in connection with photocells. Measuring devices which otherwise would be too sensitive for use in the factory can be brought with this device into the manufacturing plant. It is possible with this arrangement to use the predetermined reading of an indicating instrument to release a definite action. For instance, if the sensitive instrument shows a certain reading, a light flashes, if it goes over the limit of safety or of factory production, a protective mechanism or a rejecting device is operated.

In this arrangement, as demonstrated schematically in Fig. 3, a beam of light is controlled in its action upon a light-sensitive cell by a galvanometer. If this instrument has reached a certain reading, the light rays are reflected upon the photocell thus initiating a movement of the relay and performing a predetermined action. By using several independent photocells, it is possible to use several positions of the same indicating instrument so that each reading would perform a separate action.

Instead of the reflecting type of galvanometer, it is also possible to bring the hand of the indicator in the path of the light rays. In this case, the photocell would not act upon a relay as long as it is illuminated, but the interruption of the illumination would start the action. The engineer has to decide which of the two methods is the better for a particular function.

This principle is important in automatic inspection as the hands of the various instruments do not have to be watched. If the tested piece is over the manufacturing limit, it can be rejected automatically or at least automatically set aside for reworking.

An apparatus which uses the movement of the hand of a voltmeter or ammeter to operate a relay with the aid of photoelectric cells has been constructed by the Western Electric Company. In one case, the electro-

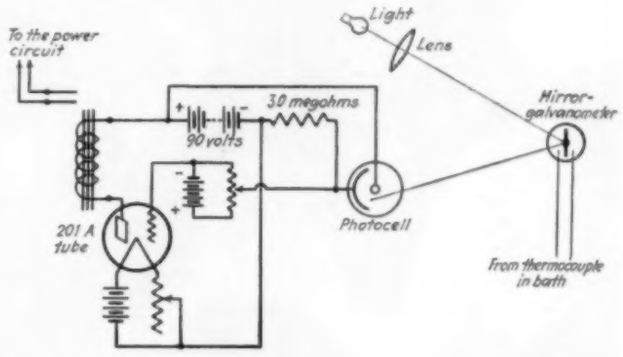


Fig. 3—Heat-treating temperatures are accurately controlled by a beam of light reflected from a mirror galvanometer. The set-up illustrated is suitable for an oil tempering or lead bath

optical arrangement has been used for reading the capacity of electrical condensers.

Thus a sensitive laboratory instrument is able, simply by intercepting or deflecting a beam of light, to bring about a mechanical action. For instance, the thermocouple which is inserted in the heating equipment can be used to move the hand of a galvanometer. If the position of the instrument goes over a certain limit, when the work temperature is too high, the light relay will open a switch and decrease the amount of electric current. Thermostatic control is thus possible for higher temperatures and for a greater precision than possible heretofore.

Electronic Color Selection

Instead of a thermocouple, it is possible to use the color of the treated object directly to operate a relay. The hotter an object the more light it sends out, and the shorter is the maximum wave length of the light transmitted. These changes can be used to operate a photo-relay as a certain light intensity is approached or as a certain color is produced satisfactorily.

Such an equipment is shown in Fig. 4. This is one of the machines of Thomson Products, Inc., in which valves are heat-treated. When the right color is reached, the electric eye operates a relay which allows the valve to fall into an oil bath. Thus overheating and the human factor of determining whether the tip has attained the right color in the heat treatment are avoided.

In coloring and finishing products, the right degree of color saturation can be determined reliably for industrial purposes by similar methods. Badly colored pieces can be rejected automatically, and the process can be regulated so as to reduce loss. For instance, a coffee factory had the coffee beans running through a photoelectric device which sorted the beans according to color.

Precision readings of fine instruments can be used to bring about an intensive mechanical action. On the other hand, the continuous flow of material can be checked and controlled during manufacture without taking samples.

A construction has been devised for registering automatically the weight of continuously flowing material with the aid of light sensitive devices. This remote-reading balance is especially useful in connection with mine products.

Almost any of the devices mentioned can be used for the purpose of counting objects which move under the light rays. This includes objects and materials upon a conveyor, visitors in a museum, or workmen passing the gate.

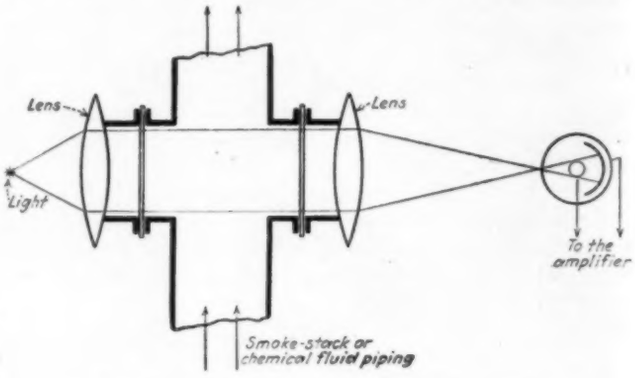


Fig. 5—Light intensity to a close degree may be measured by the photocell. Combustion control is only one of the many possible applications of this principle

The count need not be visible only at the place where the pieces pass. As the instrument is fully electric, sufficient current is available to control counting devices over great distances. In a well-known concern, the president and the general manager have counters upon their desks which indicate at any time the number of pieces which have passed the production line. The head of the factory is thus at any time informed fully as to the output. Any changes in the steady flow would be shown immediately.

Absolute light or darkness is not necessary for photo-cell operation. A diminution of light from smoke or fog for instance is sufficient to operate a photo relay. A diagram of such an arrangement is shown in Fig. 5 where a beam of light passes through a smoke stack. Any fluid, the transparency or the color of

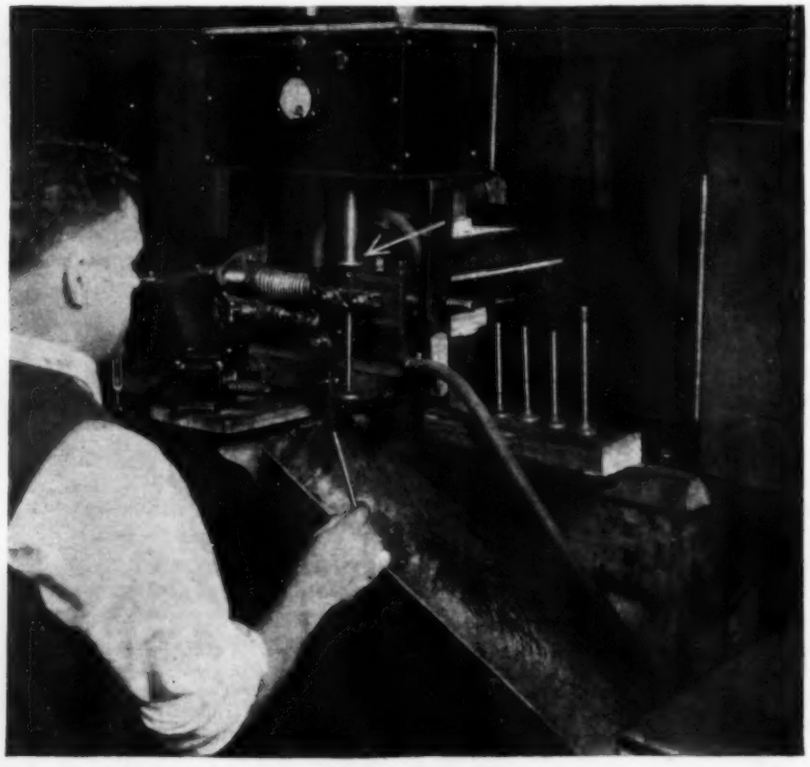


Fig. 4—Another heat-treating application uses color. When the proper red heat is reached, the valve is dropped automatically into the quenching medium

which has to be determined, can be investigated although this fluid may move continuously. This is important for the process control of chemical plants and for the control of smokeless combustion.

The light, made parallel by an optical arrangement, is sent through the testing material, collected again by a lens and thrown upon a light sensitive cell. The latter operates an amplifier of the type described before.

Besides the countless uses to which light sensitive devices can be applied there is one more important general application that should be mentioned at the present state of development. This is the light control in factories, school rooms, for advertising signs, or traffic signals. Because of sensitivity, the photoelectric cell can control automatically the light intensity and distribution at any place with greater accuracy and more reliability than the human eye. It may thus be used to bring about the right lighting with its importance in securing the greatest efficiency. Circuits similar in fundamentals to the wiring in Fig. 2 can be used in this connection.

Machine Gas Cutting—*Discussion*

C. G. BAINBRIDGE,
Welding and Cutting Department Manager,
British Oxygen Company, Ltd.

WE DO NOT agree with some of the points of view put forward in the article under the above title by L. M. Curtiss (*AM*—Vol 75, page 784) and, as we have had a most lengthy and extensive experience with machine gas cutting, we venture to put forward our views on the subject.

Mr. Curtiss mentions that tremendous grain growth occurs at the cut face; but the word "tremendous" is only comparative, and its interpretation requires careful consideration. We would point out, however, that our experience has shown that greater grain growth than that found at the oxygen cut edges of steel is very frequently found in steel forgings. Further, we thought it was fairly common knowledge that the carbon content of the metal at, and immediately under, the cut surface was increased. Most investigators, including ourselves, realized this in the early days of oxygen cutting.

Again a few tests will make it obvious that the carbon increase has been derived from the steel that has been burnt or oxidized away (kerf metal). Our view of the process is that during the cutting operation the carbon in the kerf metal is oxidized to CO which, being a most active carburizing agent, readily carburizes the face of the cut, which is at carburizing temperature. Apart from this it is possible that the iron (ferrite) in the metal at the cut surface oxidizes more readily than the carbon (pearlite) so that tests reveal an apparent enrichment of carbon.

Mr. Curtiss also states, "When the specimen is annealed, however, this carbon difference is equalized," and he gives results of analyses for the carbon content of layers taken from cut faces in the as-cut condition as well as after annealing. In this connection it is shown that in one case annealing resulted in the carbon content being reduced from 0.32 to 0.19 per cent. Surely there was some mistake about these figures, unless the annealing was carried out in an oxidizing atmosphere. The writer has dealt with some hundreds of such layer analyses, and has never found annealing to result in any decarburizing, nor would any such happening be anticipated unless decarburization took place due to the atmosphere within the annealing surface.

While it is agreed that annealing will alter the oxygen-cutting-effected microstructure to the normal structure as illustrated in the paper, it is obviously not possible to remove carbon by annealing unless this is purposely done in an oxidizing atmosphere with the distinct object of so doing. It might easily have happened that proper samples were not taken, i.e., well mixed proportions, as the carbon pick-up is not equal, and one might easily arrive at a fictitious result if great care were not taken to have the planings or millings from the layers well sampled.

Mr. Curtiss apparently ignored the results of previous investigators when he said: "The one remaining explanation for the increase in carbon on the outside gas-cut edge is that the pearlite patches in the original steel have been absorbed while passing through the transformation range, forming what is known as austenite, or a solid solution. When the cooling action starts, the ferrite is thrown out of solution first, thereby making the remaining solution higher in carbon. In view of the fact that the hottest part of the metal is next to the kerf, the carbon migrates toward this hotter zone, where it is finally concentrated."

It is, of course, well known that when steel is heated to the particular temperature required to form austenite by the complete solution of both pearlite and ferrite in the case of ordinary hypoeutectoid carbon steels, the ferrite is first to separate from solid solution on cooling and naturally leaves the remaining solid solution richer in carbon. This ferrite precipitation proceeds until the carbon content of the remaining solid solution becomes approximately 0.9 per cent when pearlite is formed, the actual percentage being influenced by the manganese content of the steel. This is natural to ordinary steel and has no connection with any increase in carbon of an oxygen-cut face.

With regard to the migration of carbon towards the hotter zone—where does this carbon migrate from? Perhaps Mr. Curtiss would make his idea on this more clear, as if a piece of steel is heated to its critical temperature (AC_3) and then one part (say the interior) becomes hotter than the outside, the carbon from the slightly cooler areas of the piece does not migrate to the inside. Why should it?

We feel that the metallurgical aspect of the oxygen cutting process mentioned in this article has not been sufficiently carefully considered, for there have been many articles in *American Machinist* already dealing with this subject, an investigation of which would have indicated the work that has already been done and the results attained from them.

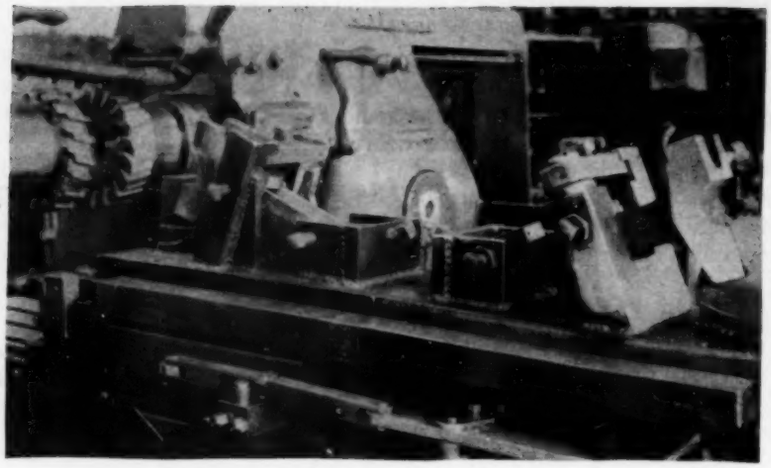


Fig. 1—Set-up time is reduced by a double-ended fixture which enables loading at one station while machining at the other

Airplane Connecting Rods

HENRY C. FRANCIS

A western engine manufacturer employs several novel fixtures in cases where accuracy in machining and inspection is a prime consideration

THE MASTER connecting rod of a radial airplane engine is a highly important member. It not only carries the power impulses of its own cylinder but also those of all the others, as the small rods bear in the master rod and transmit power through it to the single crankpin. Consequently the master rod must be strong, stiff and accurate. Two operations on the master rod of the Kinner engine are shown.

The rod is a heavy forging which is clamped in the hydraulic feed milling machine for straddle milling both sides of the big end, as in Fig. 1. The clamping fixture is simple, built up from steel plates and blocks by welding, and provided with heavy clamping screws. The fixture is mounted on an indexing table so that one end can be loaded while the other rod is being milled. The rod is easily clamped and rigidly held during the cut.

As the rod cap is a separate unit, the half hole in the big end has to be drilled or bored. This is done by using a double fixture that

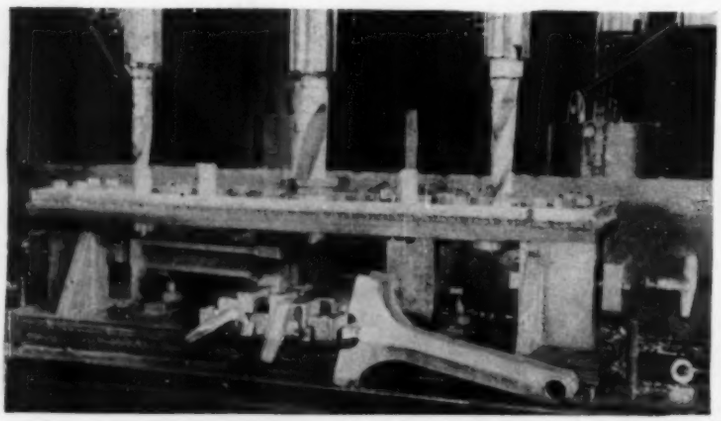


Fig. 2—Production and precision are combined in a jig which drills two main rods simultaneously and maintains exact center distances

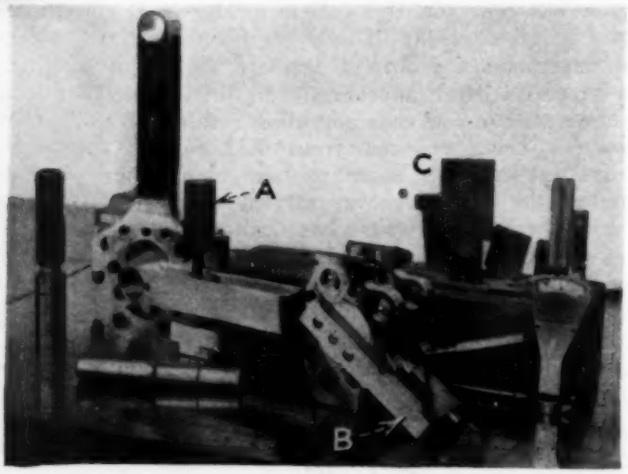


Fig. 3—These inspection devices insure the extreme accuracy to which the main connecting rod must conform

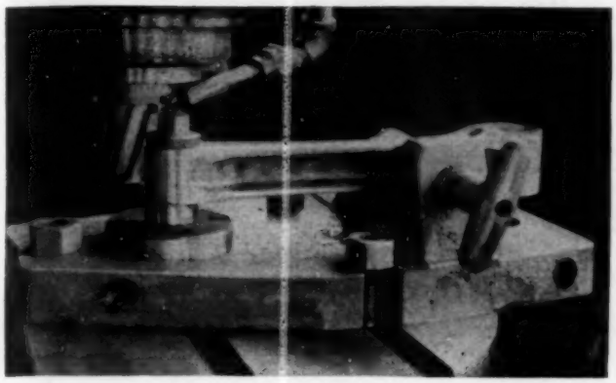


Fig. 4—A simple fixture on a revolving table facilitates milling the ends of the small rods

not only handles two rods at once but eliminates the difficulty of the half hole. The large ends of two rods, that have been previously milled, are butted together in the fixture, Fig. 2. They are easily located to bring the parting line at the center of the hole, and the whole rod clamped in position. Then three spindles of a Hole Hog machine are positioned to drill the big end of the two rods and both small ends at the same setting. The second rod is removed to show the point of the large drill as it comes through the central bushing. This fixture was also built up from plates by welding.

These rods are finished all over and are held within close limits. The gages and some of the methods of testing are shown in Fig. 3. All inspection gages for any particular piece are kept together in one box or block as the case may be. This enables the inspector to see at a glance that all gages are there and makes it easier for all concerned. Flush pin gages are used where it seems advisable as in *A* and *B*. The first checks the thickness of the web of the rod, a step on the end of the pin showing at a glance or by feeling whether the dimension is within the limits prescribed.

The gage *B* checks the thickness of the rod all around the crankpin bushing. A hollow plug goes in the bearing hole of the rod, the flush pin making contact between the rod flanges. The gage is then turned in the hole to check the thickness at all points to prevent interference with ends of the small rods when they are in place. By keeping the finger on the end of the gage pin as he turns the gage in the hole, the inspector can instantly detect any variation in thickness. The flat gages *C* check the distance between flanges of both the small part of the rod and those which hold the smaller rods. One of the smaller rods and the rotating fixture for milling the ends can be seen in Fig. 4.

Temperature Control of Quenching Baths—*Discussion*

E. E. HALLS
New Barnet, England

THERE are two features in R. H. Ure's notes on the above (*AM*—Vol. 75, page 968) upon which I think comment will be of practical interest. First, the fire hazard of oil baths for quenching is real and not a mere fallacy. The oils most widely used (whale oil, mineral oil, compounded mixtures) flash on open test when new from 200 deg. C. (392 deg. F.) upwards according to the particular one employed, and their burning points are frequently in the neighborhood of 20 deg. C. to 30 deg. C. above this figure. The attached table records the average figures of a number of determinations.

In use, the insertion of hot metal from about 800 deg. C. (1472 deg. F.) causes some decomposition and cracking, with the production of more easily ignitable constituents, and a gradual reduction of the burning point to a lower value. The real danger enters with the latter. Cleanliness and careful control in replacing the used oil at frequent intervals with entirely new medium are essential to minimize the danger. In all cases, however, the fire risk warrants the installation of fire appliances and the assurance that operators are familiar with their use.

Second, in endorsing Mr. Ure's remarks concerning the special nature of electroplating processes for hardened steel components, it seems important to establish a more optimistic outlook on this question, chiefly for two reasons:

1. Where intensive protection is necessary, electrocoatings are the best solution, being the least costly where dimensional limits also are a factor.

Flash and Ignition Points of Quenching Oils

No.	Name	Flash Point Deg. C.	Ignition Point Deg. C.
1	Sperm	265	323
2	Cotton Seed	305	340
3	Rape	240	348
4	Whale	246	270
5	Proprietary Brand A	213	260
6	Proprietary Brand B	209	269
7	Proprietary Brand C	201	248
8	Proprietary Brand D	177	194

2. Controlled plating processes do not mean prohibitive cost; the investigational work precedes the mass treatment, decides the process and control, and need not form part of it.

The problem of hydrogen occlusion is bound up with pre-dipping in acid and also in stripping faulty platings and replating. Plating can be effected in ordinary solutions without setting up stresses sufficient to produce cracks. Flat springs plated by the writer in a standard cadmium solution (in which the cathode efficiency is relatively low) showed a reduction of 60 per cent in the angle through which they would bend without fracture, but in service where the actual deflection was something of the order of one degree, they proved quite satisfactory. Again, helical springs from small sizes of the order of ½ inch long x ⅛ inch diameter and upwards are on the market efficiently cadmium plated.

Temper coloring affords little protection from rusting, and such springs will badly corrode within 24 hours under conditions of 100 per cent humidity. A good covering of a viscous petroleum jelly or lanoline must additionally be applied, and where this is not tolerable, electroplacting is the only safe resort.

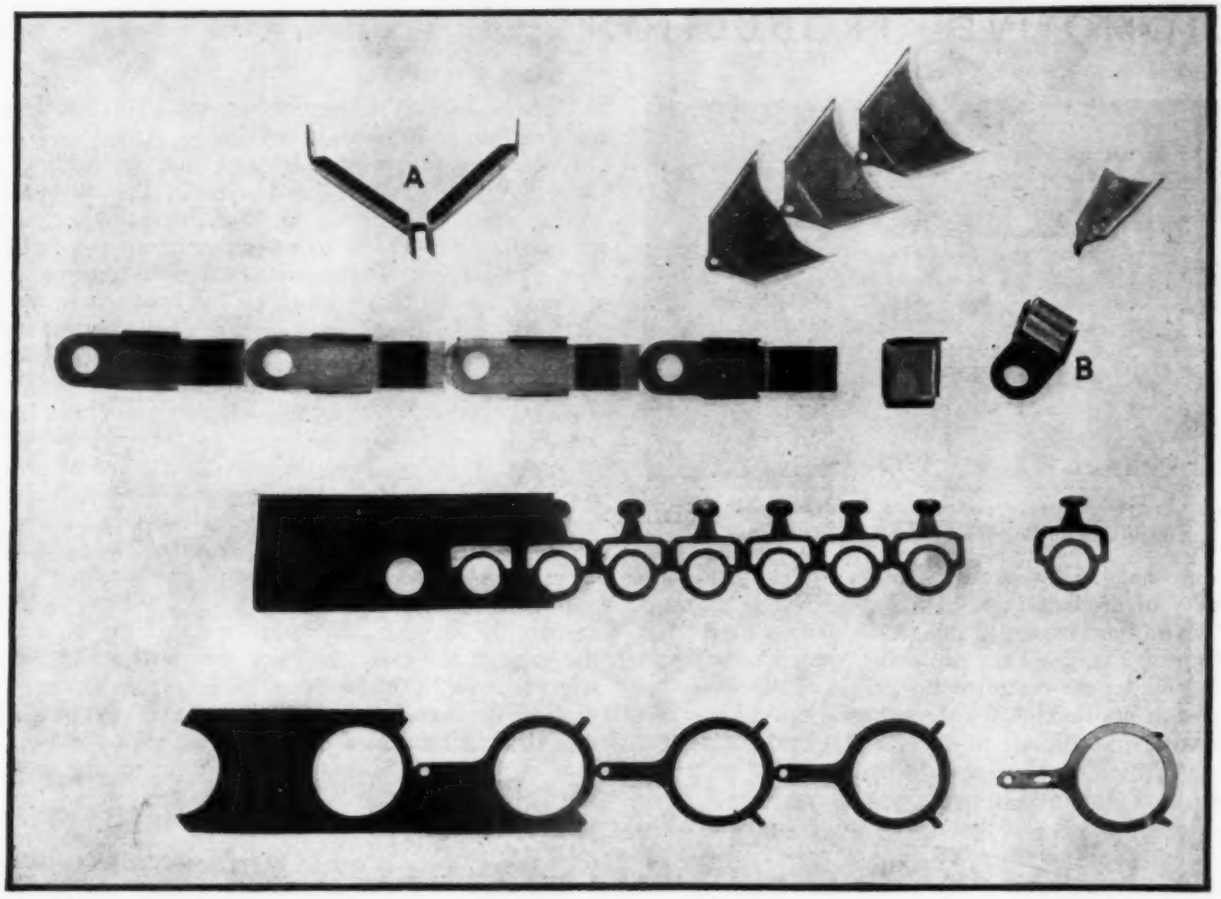


Fig. 1—These parts are made on a multi-slide press at the rate of 125 to 300 per minute

Tooling for Multi-Slide Machines

C. W. HINMAN
Chief Tool Designer, Kobzy Tool Company

THE FUNDAMENTAL principles involved in the operation of the U. S. Tool Company's Multi-slide blanking and forming machines are similar to those of the automatic screw machine; i.e, cams control the motion and time the action of the cutting tools that operate on the work material.

This machine is a finely adjusted, light, punch press, built in a horizontal position. The stock strip is unrolled by the feed of the machine, as needed, from a horizontal reel, placed on a separate floor stand on the left. It passes "edge up," first through a series of straightening rolls, then through the feeding jaw, next across the length of the die block, and finally between the front and back forming tool slides. The moving direction of the strip is from left to right. The ram is in the front of the machine, where the operator stands, and the bolster is at the back. Both are independently adjustable either to the right or left. The ram also has the usual screw adjustment for controlling the die space.

At the right of the ram and bolster, and parallel with them are the front and back forming tool slides mounted in line, facing each other and fitted in a dovetailed cross slot in the bed of the machine. Directly above these cross slides, and near where these slides would meet if equally advanced toward each other, is an over-hanging arm in which is a square opening $1\frac{7}{16}$ x $1\frac{7}{16}$ in. for a vertical forming post or work ejector, operated by a right-hand side cam. This arm is adjustable toward the front or back of the machine. There are two other tool slides, one on the right-hand side of the front and back slides and the other to the left of them. The back edges of these slides are in line with the face of the bolster plate. These slides also face each other, in line, and operate in a dovetailed slot at right angles to the front and back slides, and in the same plane with them. They are also slotted in the bed of the machine.

The stock strip line in the No. 25 U. S. machine is located parallel with the face of the bolster plate and $1\frac{5}{8}$ in. from it. The center line of the stock strip is parallel with the bed and $1\frac{1}{4}$ in. above it. The maximum width of the stock strip used is $1\frac{1}{2}$ in.

At the extreme left edge of the bolster and coincident

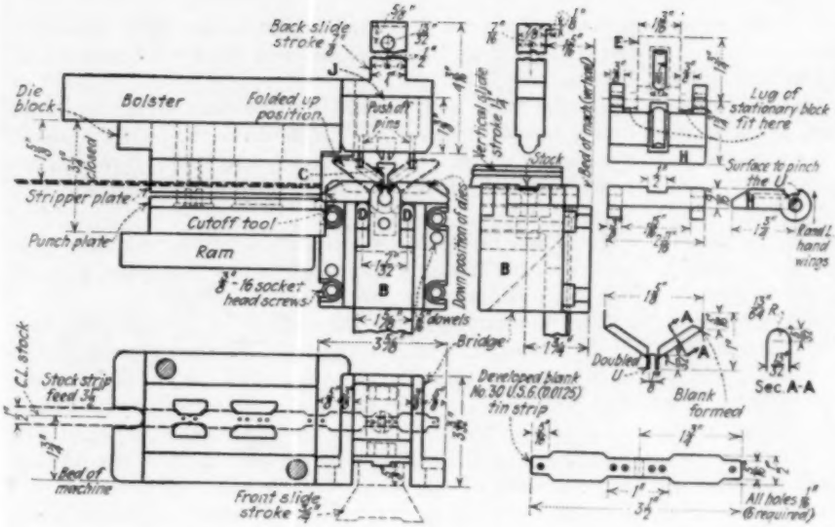


Fig. 2—Tooling for landing gear for a miniature airplane. A difficult job by any method

with the center of the stock strip, is an adjustable pressure pin, cam-operated from a rear shaft. The face of this pin contacts the stock firmly when the feeding jaw recedes for feeding the strip, and removes its pressure when the jaw is ready to feed forward.

All the tool holders have a reciprocating movement, except the bolster. The ram and the four tool slides, including the vertical forming post and work ejector, are surrounded on four sides by shafts driven by inclosed miter gears at their ends. On these shafts are mounted the cam disks each having an interior irregular slot for a roll follower to suit the movement of its attached tool slide. All the cams may be secured at any desired rotating position for controlling the time interval for the operation of any tool. The length of feed is extremely accurate; on short lengths it is within 0.0005 in. Gears can be exchanged on the motor for obtaining the proper output. The output runs between 125 and 300 finished pieces per minute.

By using such an array of adjustable mechanisms, an experienced tool designer is able to produce a large assortment of light stampings, blanked, formed, and sometimes even assembled where the parts are made from two strips simultaneously. All operations are automatically performed, and some almost unbelievable shapes can be fabricated with no other attention than an occasional replenishing of the stock roll. Pieces may be fastened together by shearing two or more lugs and forming them down on the opposite side.

Quick and Inexpensive

Tooling the multi-slide machine is quick and inexpensive. Generally the perforating and blanking is done under a positive-type channel stripper plate. The die set is small, the die block need not exceed ½ in. in thickness, and the punches seldom exceed ¾ in. long. The blank is made by notching away the stock strip from both edges. The blanks are connected by a small neck to facilitate feeding them from under the stripper plate and between the front and back forming slides. The connecting necks are severed by a conveniently placed cutter, just before the forming occurs.

In Fig. 1 at *A* is shown the axle support for the "take off" and landing wheels used in a miniature airplane. Fig. 2 shows the die set, the notching punches for making

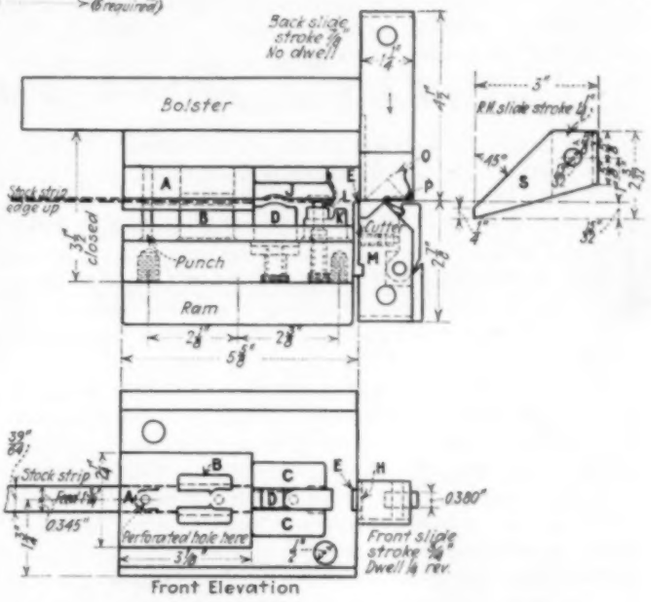


Fig. 3—Some especially ingenious designing is necessary to produce this clip with its numerous bends

the blank, and the assembly of the perforating and blanking punch and die.

This job differed from the general run in that the forming of the "doubled U" had to be done over a positive punch held in a "bridge" *B*. This bridge was rigidly secured on the bed of the machine at the immediate right of the press ram, and its channel covered the front tool slide. This design had preference over others, because we obtained the desired positive forming punch *C* for the double U and still had use of the reciprocating front slide, underneath, on which to attach the die folding slide *D*. The two noses of the slide contact the under sides of the right and left hand forming dies *E* and *H* and fold them equally together with the horizontally formed work within.

These "folding up forming dies" are pivoted in a central position on the upper end of the bridge so that, when both dies lay flat upon it, for the first forming position, they present a straight-away channel ½ in. wide and in line with the face of the blanked strip. Thus they receive the successive blanks within the channel. The function of the channel is to prevent the blanks from fall-

ing out of the forming dies after severance, if the forming punch should contact the blank too late.

Six $\frac{1}{16}$-in. diameter holes are perforated in the blank. The four holes located in the sides of the double U must line up accurately through double thicknesses of the stock after the U is formed. The U is tightly compressed by the pinching of two flat surfaces *H* on either side near the pivoting pin.

To prevent the U from slipping off its forming punch when the dies are folded, a sliding support is brought down on the vertical slide and slips along the bottom of the U, timed to clear the face of the receding forming punch *J*. In the face of the forming punch are two "push off" pins which cause the work to remain in the dies while the punch recedes. Two tension springs (not shown) return the forming dies to their normal position as the controlling slide backs away. An air jet, also cam operated, blows the finished pieces through an opening in the bed of the machine, between the horizontal slides, into a suitable receptacle below. The rate of production is 125 pieces per minute.

A Difficult Design Job

The tools shown in Fig. 3 are for producing the sheet brass contact spring clip, shown at *B*, Fig. 1. These tools entailed some difficult designing. The material, 0.025 in. thick and $\frac{29}{64}$ in. wide, is purchased in large rolls. The length of the blank is $1\frac{1}{4}$ in.

The chief difficulty arose from the five forming operations, the last operation doubling the stock back on itself with a very small margin for holding the work while doing so.

The stock strip enters over the face of the die block *A*, under a positive-type channel stripper. In the first step the 0.221-in. diameter round hole is perforated, and the sides of the strip are cut away to leave the blank contour. The two punches *B* are both backed up with heels that enter the die before the cutting occurs. These punches are located opposite one another and leave the usual connection between the ends of the blanks to enable them to be fed along to following operations.

In the next step, the blank, now complete, comes out from under the channel stripper plate and slides over the narrow forming block *C*. The width of this block is the same as the distance between the two formed wings on either side of the blank. At the left-hand end of this forming block is a concave arc *D*, which conforms to the curve in the doubled-over end of the piece.

When the punch ram closes, three bending operations are performed and the blank ahead is severed by cutters *E* and *H*. The three forming operations are: Punch *D* on a spring, forms the arc in *J*. Forming punch *K* throws down the two opposite wings, and since the blank ahead has been cut off, detail *K* also turns down the cut end of the doubled-over part, against right-hand end of the forming block. During these three forming operations, a pressure pin *L*, backed by a compression spring, holds the blank flat on the forming block, between the front and back forming tool slides *M* and *O*. The front slide *M*, is held stationary by a dwell on its cam, for one quarter of a revolution. During this time it is in alignment with the on-coming partially formed blanks from the forming V-block *J*. When the back slide forming tool *O* advances, it straddles outside the formed wings on the work, and also carries an open slot over the end of the work that is later doubled over. This precaution prevents the work from falling out of the back tool, after the cutters *E* and *H* have severed the neck between the blanks.

As the back tool continues to advance with the blank firmly held between stop *P* in the back tool and the inside the cutter *E* on the front tool, the large right-angled bend begins to form in the V dies shown in these two forming tools.

It should be noted here that the feeding distance is so accurate that none of the usual locating or pilot pins, as used in ordinary dies, are necessary.

The V-forming die in the back slide *O* has a solid face in its left angle, while on the right side the forming angle is cut away to clear the curved end of the clip, so that the bearing, when forming, is only on the edges of the formed wings of the work. This design allows the curved end of the clip to be formed as desired, over against the 45-deg. angular side of the work. This final operation is performed by bringing in the finger *S*, attached on the right-hand slide. This finger contacts the side forming lever *T*, which is shaped to form the curved portion of the work, giving it the necessary spring set.

When the forming tools recede, an air jet blows out the finished piece. This tooling produces 150 pieces per min.

NEXT WEEK

Many articles have been written on the merits and limitations of cemented carbide tools, but few have presented an exhaustive analysis of the shop economics involved. In next week's issue, M. E. Lange reports his findings on the application of carbides to turret lathes from the dollars and cents viewpoint. His conclusions are illustrated with actual production jobs.

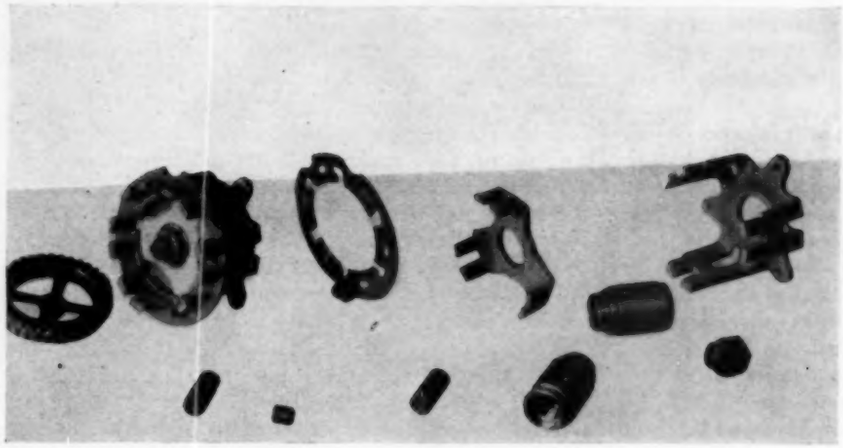
Rust, the persistent destroyer of iron and steel, must be vigilantly guarded against. E. E. Halls describes a variety of slushes that have proved effective for temporary protection.

The economies and other advantages of using reamer-section high-speed steel in tool making are told by H. M. Darling. Other topics of interest include plating in the laboratory shop, training apprentices in Soviet Russia, and several picture pages showing how Navy aircraft is kept in trim.

IN A. M.

Refrigerants in Manufacturing

New industrial uses for solid carbon dioxide are coming so fast that they get ahead of us occasionally. American LaFrance is now using crushed solid carbon dioxide as a refrigerant in contracting cylinder liners to make an expansion fit, thus avoiding heating of the cylinder block. A golf ball maker uses it first to freeze ball center in order to keep them round while the outer coating is applied, then freezes the molded ball in order better to trim the finished product.



Parts of a 200-r.p.m. sub-synchronous electric clock motor. An assembled field is also shown

Electric Clock Motors

With the advent of electrification, the driving mechanism becomes the least expensive part of the clock

HOW can an electric motor be produced that is dependable enough to drive a clock and still be inexpensive enough to permit of its sale in large volume? Two answers to this question have been found by the Wesinghouse Electric & Manufacturing Company. The motors are being produced in its Newark plant where the machine equipment and experience necessary are available. This plant has long manufactured meters and other instruments of precision.

The major portion of the parts for the 200-r.p.m. motor involve blanking, forming and turning operations. The upper and lower pole pieces are stamped, formed and milled to the necessary accuracy and face angles. Before assembly they are cadmium plated to prevent rusting. For the same reasons, the central core is made from stainless steel. The core serves not only as such, but also holds the two pole pieces together and houses the single central bearing for the armature shaft and the special lubricating means described later. A pair of copper disks with slots arranged to fit over the ends of the two pole pieces serve as an electrical lagging for the pole and also assure that the poles are held in correct angular and radial position when the assembly is made.

Central Bearing

Phosphor bronze is used for the central bearing, which requires exceptional precision in its manufacture. It is turned from bar stock in a watch-type screw machine, which drills and reams the hole for the shaft and the recess at the other end and turns the outside diameters, including the taper at the rear end. This bearing is made a press fit in the core, but its outside diameter for a length equal to that of the bearing bore is relieved 0.010 in. so that pressing the bushing into place will not affect the bore of the bearing which is held to the very close limits of 0.0583—0.0586 in. diameter. This hole is finally finished by burnishing with a round-nose polished plunger, forced through the hole on a small hand-operated arbor press.

After the bearing hole is finished, a sapphire thrust bearing is inserted in the hole of a brass washer which is seated at the back end of the bushing. This hole is made about 0.002 in. larger than the diameter of the sapphire, and the washer is slightly thicker than the sapphire, so that the latter is free to float.

Back of the washer and the sapphire is placed a thin circle of bellows leather wet with lubricant, and behind this a cylindrical block of porous Boundbrook metal. The latter is held in place by spinning over the end of the bearing. These two operations are done in a small bench turret lathe which has been developed especially for this and similar jobs.

Tooling for the Armature

Although the armature or rotor assembly appears to be relatively simple, it represents a neat job of tooling and stamping. The armature itself consists of four steel, one brass and two copper stampings. Five of these are flat and the sixth, which is the outside spoked plate to which the shaft is fastened, is blanked and then formed in an assembly operation which binds all six stampings together. Thereafter the four openings between spokes are cut out in a punching operation. All these operations are performed on No. 18 Bliss presses.

The five plates that form the four steel laminations and the copper back member of the assembly are annular disks the outer edges of which are serrated to receive the copper segments that are formed by punching radial slots in the sixth disk. There are 36 of these segments or teeth and their width is just equal to the thickness of

the copper sheet, which is less than $\frac{1}{16}$ in. These teeth have to fit the slots cut in the other five stampings and must be forced into these slots. This requires hand stacking and correct location of all six stampings in the forming die, but the relative cost of the assembly is not by any means high.

After this assembly in the punch press it is necessary to solder the end of each segment to the back copper disk. This is done by dipping the assembly into heated solder.

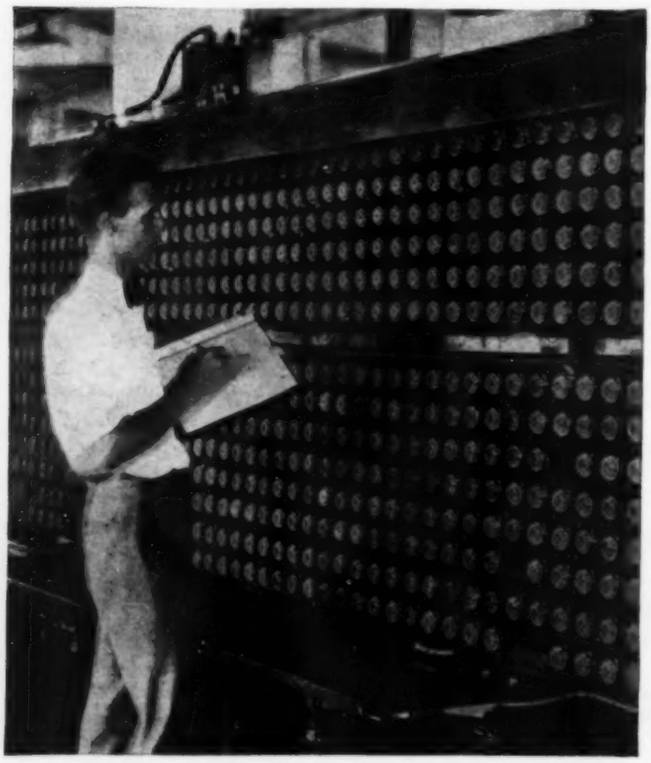
Immediately after removing the assembly from the solder it is placed in a light hand press to force the parts together and squeeze free any excess solder. The assembly is then allowed to cool, after which it is chucked in a No. 2 bench lathe were all surplus solder is turned off the inside diameter and back face. The hole in the center of the spoked member is also bored and reamed to receive the shoulder of the pinion which fastens against it.

This steel pinion has 15 teeth and is cut from bar pinion stock in a Petermann screw machine which forms the shoulder and drills and reams the hole into which the shaft is pressed. The shaft is held in a jig in a light arbor press while the pinion is being forced onto it. After this operation the assembly is gaged to make sure that the distance from the pinion shoulder to the end of the shaft is held within the required limit of 0.0005 in.

To attach the shaft-pinion assembly to the rotor assembly, the shouldered end of the pinion is placed in the center hole in the spoked member and the two are staked in a small hand-operated drop hammer. This assembly is next chucked on the shaft and the outside diameter of the rotor is ground to size within 0.001 in. limits.

The shaft for the rotor is made from tool steel and has both ends rounded, the inner one to rest against the sapphire and the outer one to bear against a light flat spring which is attached to the frame of the clock movement to which the motor is to be fitted. Shafts are cut off and the ends are formed in an automatic Derbyshire shaft machine. The ends are then rounded and polished in a watch lathe, in which a box tool is employed. After hardening, shafts are run through a Cincinnati centerless grinder which holds them between the limits 0.0578 and 0.0580 in. The shaft length limits are 0.554 and 0.560 in. Shafts are finally polished by tumbling in a water solution of Vienna lime, but the tumbling barrel is quite different from the ordinary type. It is an iron tube about six inches in diameter by two feet in length and is not arranged to rotate about its own axis. Instead, it is mounted on a shaft at right angles to its own axis and is given a very slow rocking motion about this shaft, using a crank linkage. The shafts to be polished are placed in this barrel several thousand at a time and as the barrel is rocked the shafts do not rotate but slide over each other and up and down the barrel in the direction of its and their own longitudinal axes. This gives the high polish required without any material change in diameter.

From the foregoing it will be seen that the size of the shaft and of the hole are held within limits that give a clearance space of only 0.0005 in. in the average case, a clearance which is filled by the film of oil which covers the shaft at all times, but permits of no excess flow of oil and no appreciable shake in the bearing.



A portion of the test board holding nearly 2,000 assemblies which are run for 12 hours

Major Assembly

Except for a few minor machine operations performed during assembly, no further machining is required. All sub-assemblies, save that of the field coil which is made on standard coil machines and will not be dealt with here, are completed. Only the major assembly and test remain.

Nearly all assembly operations are performed on the bench, and only hand-operated tools, chiefly arbor presses, are required. Most of the work is done by girls who remain seated during most operations but often do more than one operation which may involve occasional change in seats. Parts, being small and light, are passed along by hand, usually in boxes or trays.

In the first assembly operation the core is pressed into the lower field, being held in correct position by a jig in the arbor press. The parts are then inverted and the core is staked to the frame. After the coil is placed in postion with a paper washer at each side, the assembly is ready to receive the upper field frame. Before the latter is applied, however, the two copper lag rings are assembled to it in a hand press. This sub-assembly is then slipped over the core and pressed home against the coil. The lag rings are also seated against the shoulders of the poles, after which the shoulder of the core is staked to the upper field frame.

Except for insertion of the bearing and the screw in the bottom of the core, the assembly is now complete. It is necessary, however, to face off the burr left by the staking of the core to the lower frame, and also the three attaching feet of this frame, so that the latter will be in a plane at right angles to the axis of the motor. This is done in a bench lathe in which the assembly is chucked for the purpose. The bearing assembly is next slipped into the recess in the core and is pressed into place in a light arbor press provided with a stop to prevent excessive pressure to the bearing. A special set-up involving a dial gage is then employed to measure the vertical distance between the plane of the attaching feet and the plane of the bearing face of the sapphire, which must be held within ± 0.002 in. of the specified dimension.

Double-turret bench lathe. The tool turret indexes in the usual way. The rear or gaging turret indexes automatically with the other

Since the air gap between the rotor periphery and the poles is important as affecting the proper speed and running of the motor, the poles are positioned accurately with a special tool fitted in a hand press to assure a gap of 0.020 in. Another press is employed to test the bearing and make sure that it is tight in the bore of the core. This press is provided with electrical contacts which close and light a small lamp in the event that the bearing is loose. A plug gage is also used to make sure that the hole in the bearing has not been closed in.

The assembly is next sprayed with a clear quick-drying lacquer. During this spraying the assembly is held on a rod so arranged as to protect the bearing and prevent any lacquer from entering it. After lacquering, the tapped holes on the three supporting feet are retapped. A cylindrical plug of felt is next placed in the core recess below the bearing, after which this recess is filled with a special grade of oil, called refrigerator oil, and the screw which closes the recess is inserted. The oil thus provided can reach the bearing surface only by passing through the porous plug of Boundbrook metal, the washer of bellows leather and the small space around the sapphire. This insures the very slow feed required but provides an ample supply of lubricant for at least two years and probably for a much longer period.

Final Assembly

In the final assembly operation the rotor shaft is inserted in the bearing and the rotor is spun by hand under a test gage. In this test a potential of 2,000 volts is applied to the coil terminals. The motors are placed in recesses in a slowly rotating disk of fiber which carries them under a glass cover and past the high tension terminal. As the motor passes this terminal the trailing leads and their terminals slide across the terminal and if any ground occurs a light flashes.

Following the ground test, all motors are given a running test for a total of at least 12 hr. The test board, shown in an accompanying illustration, is provided with horizontal lines excited to the proper voltage. During the test the motors hang on nails driven into the board in such position that the motor is centered between leads protected by circular loom except for bare spots where the motor inlead lugs are attached. At these points the wire of the lead is tightly coiled so that when the lug is slipped between adjacent coils a secure contact is quickly made.

Each motor is first run at the normal voltage for which it is designed and starts itself instantly the circuit is complete, quickly assuming the constant speed of 200 r.p.m. at which it is designed to run. To check the speed, neon lights operated off the same circuit are employed to give a stroboscopic effect. Under this light the rotor segments appear to stand still if the speed is exactly correct. If, however, the speed is not correct, these segments appear to rotate forward or backward and some adjustment is required.

Under normal voltage the motor assumes a normal temperature of about 120 deg. F., but if the voltage is raised the temperature naturally increases. To make sure that a higher than normal voltage will not have any detrimental effect, especially on speed, a higher voltage is applied during a part of the 12-hr. test and the temperature is raised thereby to about 160 deg. F. Adjustment usually can be made to remedy any defect or abnormal speed, but of course, if no remedy is found the motor is rejected.

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Salvaging Worn Bushings

Discussion

HARRY SHAW

Consulting Engineer,
Heywood, Lancashire, England

IN AN ARTICLE under the title given above (*AM*—Vol. 75, page 953), F. W. Cheatham describes a method of closing in worn bushings by upsetting them in a hydraulic press and then sizing them by reaming.

Not every shop has a hydraulic press, so the following method employed by repair shops of the writer's acquaintance may be of interest: The worn bushing is pressed out and is knurled on the outside. Since the knurling enlarges the outer diameter slightly, when the bushing is pressed in place again it closes somewhat. The inside is then trued up by reaming.

A rather novel way of bringing a badly-worn bushing to size was employed by a mechanic in a mill that was situated "miles from nowhere," when it was not convenient to obtain a new bushing and time was valuable. He took the bushing out and built a layer of solder about $\frac{1}{8}$ in. thick all around the outside. After truing up this layer and tapering the leading end in the lathe, the bushing was pressed into position. It closed sufficiently to allow it to be reamed to the required size along the whole of its length.

IDEAS FROM PRACTICAL MEN

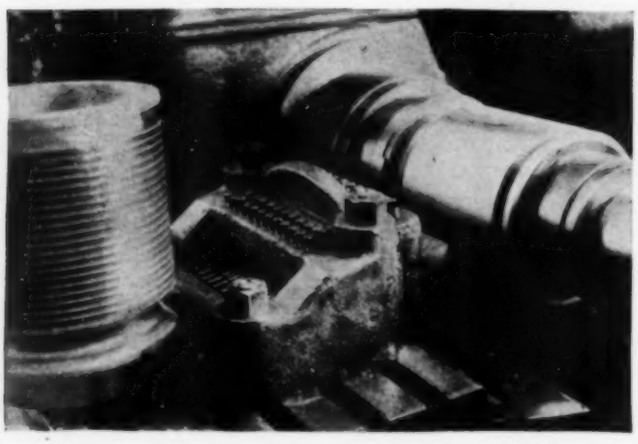
Finning Air Cooled Cylinders

E. L. MARKS

CUTTING thin or narrow fins on steel cylinders for air-cooled aviation engines is not a job to be sought, as it requires careful attention to tools. In the set-up shown, a cylinder blank is held on an expanding mandrel but the drive is also reinforced by having the flattened sides of the flange fit between projecting lugs on the collar of the expanding mandrel. The tool block shown in front is for the finishing cut. A similar tool block is carried at the back end of the slide for the roughing cut.

The tools are virtually parting or cutting-off tools and must have both proper side clearance and be spaced the right distance apart, as the thickness and spacing of these cooling fins are important in the performance of the engine. It is Kinner practice to make the roughing tools not only somewhat thinner than those for finishing but to feed them in to a slightly greater depth. Then when the finishing tools go down into the slots it leaves a square shoulder each side of each fin, as strengthening metal, which is an unconventonal fillet. While a round fillet is to be preferred, the difficulty of maintaining tools with small rounded corners makes the method adopted advisable.

There are 24 tools in each holder, held and adjusted by an equal number of setscrews and special adjusting screws at the back. These screws are staggered owing to the close center distances of the tools. As the finished fins are only 0.040 in. thick, the necessity for close tool setting becomes apparent. The tolerance is close, and the sides of the fins must be smooth, both conditions making the tooling problem one that requires constant attention. The tools have a 2-deg. side clearance and are set a trifle above the center.



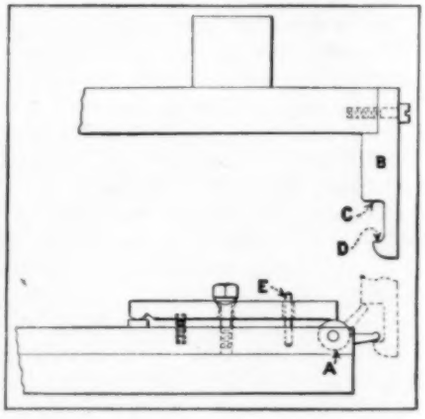
Experience with this particular job has overcome many of the problems that were both costly and annoying in the beginning. The first tools would not give over 15 cylinders per grind and the cost of lard oil was almost unbelievable and prohibitive. The present practice, with cobalt high-speed steel tools and a mixture of half-and-half paraffine and amber oil, which can be supplied by several of the oil companies, gives them 100 cylinders per tool grind. This means removing 1,500 pounds of chips from the larger cylinders at the rate of 9 minutes per cylinder.

The tools are ground in the block, a fixture on the grinder holding them in the same position as in the lathe. When the tools are ground so that the space between them is wider than the fin plus the tolerance, they are used for the roughing cut and new tools used for finishing.

Attachment to Prevent Blanks From Slipping

CHARLES KUGLER

In piercing and forming metal over $\frac{1}{8}$ in. thick, there is sometimes a tendency for the metal to slip, producing inaccurate work. There are many methods employed to prevent this slipping. Sometimes a pad is used on the punch equipped with stiff springs that are compressed as the ram descends. I have known this method to fail, but the attachment illustrated has been used with good results. The sketch gives a good idea of how the device works. No attempt has been made to show it as applied to any particular job, so that diemakers are left to design it to suit their particular needs.



One end of the pivoted clamp holds down the stock as the other end is raised by the action of the eccentric *A*. The arm *B*, which is attached to the punch-holder, operates the eccentric lever. As the ram descends, that part of the arm at *C* comes into contact with the eccentric lever and pushes it down, clamping the stock. As the ram ascends, that part of the arm at *D* pulls the lever up and releases the stock, the lever being shown in this position by the dotted lines.

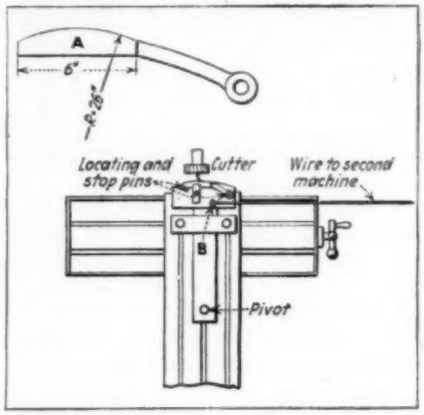
When the clamp is loose, the tension of the coiled spring keeps it above the die so that the stock can be pushed under it. The pin *E* keeps the clamp in position. The application of this attachment is limited because the

ram must be set in a position to suit the eccentric lever, otherwise an accident may occur if the ram is permitted to come down too far. I believe, however, that the arm could be made in such a way as to eliminate this danger. All parts that are subject to wear should be hardened.

Milling Work of Long Radius

ROBERT S. ALEXANDER
Machinist, Special Department, Universal Winding Company

In milling the piece shown at *A*, it was essential that the curve of 26-in. radius should be reasonably accurate. The work was accomplished by the aid of a swiveling fixture and two milling machines, the tables of which were fortunately in line.



The fixture illustrated was pivoted to an auxiliary table, which in turn was securely clamped to the table of the first machine, both tables remaining stationary. A heavy wire was looped through the small eyebolt *B* in the fixture, the other end being securely fastened to the table of the second machine.

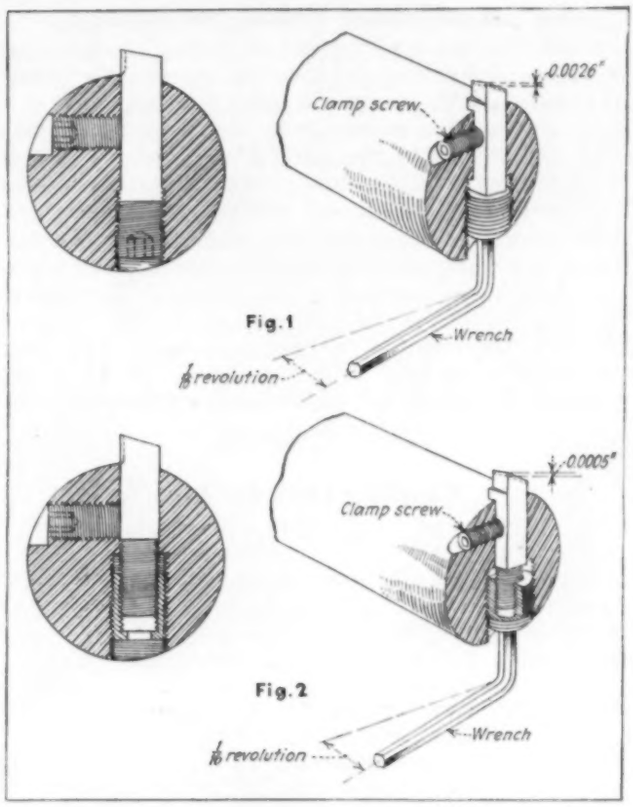
When the second machine was put in operation, the table pulled the wire and swung the fixture on its pivot. The work in the fixture was thus fed past the cutter in the spindle of the first machine, in an arc having a radius equal to the distance between the center of the pivot pin and the face to be machined.

Micrometer Adjustment for Boring Cutters

PETER F. ROSSMANN

The most common difficulty encountered in boring is, that when adjusting the cutter for hole size, too great a movement often occurs. Subsequently, there is a tendency to make frequent adjustments and trial cuts before reasonable accuracy is assured. The cause of this annoyance is that the pitch of the adjusting screw is too coarse to permit its accurate movement. As shown in Fig. 1, the square cutter is adjusted by a $\frac{3}{8}$-in. screw, the finest practical pitch of which, without the use of special taps and dies, is $\frac{3}{8}$—24, SAE standard. This screw would advance the cutter 0.0416 in. per revolution. Assuming that the cutter needs to be advanced 0.001 in. Then 1/40 revolution of the screw will be necessary. Considering the sweep of the wrench end, it is difficult to visualize its angular movement within $\frac{1}{16}$ revolution, or an advance of 0.0026 in. of the cutter. So it is largely a matter of chance if the correct size of the hole to be bored is obtained in one trial.

However, fine adjustment is possible by the use of the differential-thread method indicated in Fig. 2. The



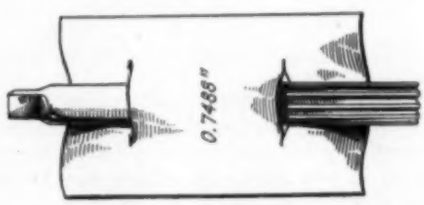
lower part of the cutter is cylindrical and is threaded $\frac{5}{16}$—24, SAE standard. The adjusting screw is $\frac{7}{16}$ in. and is threaded $\frac{7}{16}$—20, SAE standard, the inside being tapped to accommodate the thread on the lower part of the cutter. One revolution of the screw will advance it 0.050 in. and at the same time the cutter will be drawn back 0.0416 in. Therefore the actual advance of the cutter will be equal to the difference between the pitch of the thread on its shank and that of the adjusting screw, or 0.0500 — 0.0416 = 0.0084 in. Therefore, $\frac{1}{16}$ revolution of the screw will move the cutter 0.0005 in. as compared with 0.0026 in. in the first case.

In cases of severe duty that might necessitate frequent regrinds of the cutter, it could be round instead of square to facilitate removal and assembly. In that event, the cutter must be flattened so that the clamping screw will hold it with the cutting edge in the right place.

Marking Odd-Sized Reamers

MARTIN H. BELL

Undersized reamers are frequently needed in jobbing shops and in repair departments of manufacturing plants for reaming holes to fit a worn shaft or stud, where force fits are required, or for any reason a hole smaller than standard may be necessary. The following method affords a simple way of marking undersized reamers or other tools.



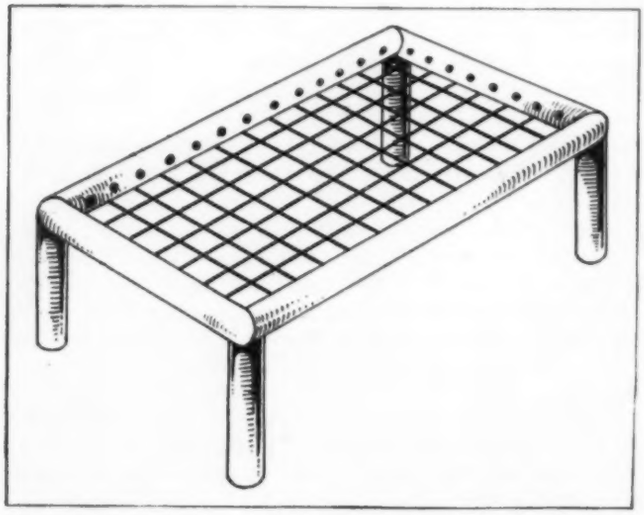
One center punch mark following the size marked on the tool indicates that the tool is 0.0001 in. undersize, thus: $\frac{3}{4}\cdot$. When the tool becomes worn to the extent of another 0.0001, one punch mark is added, thus: $\frac{3}{4}\cdot\cdot$. For convenience in reading, these marks are kept in line until they amount to five, thus: $\frac{3}{4}\cdot\cdot\cdot\cdot\cdot$, and for greater wear another line of punch marks is started, thus $\frac{3}{4}:::::$ indicates that the tool is 0.0012 in. undersize.

Where the shanks of the tools are hardened, or where they are too small for such marking, card marking is sometimes more convenient. By using a card appropriate to the size of the tool and cutting two slits near the ends, the tool can be inserted through them, and the complete marking in figures can be placed in the center of the card in ink, as indicated in the sketch.

Cooling Dies by Air

CHARLES F. HENRY

In the die shop of a large bolt-making shop, I recently found three methods used for cooling dies. In addition to the usual cooling tanks filled with oil and water respectively, there was an air cooling table, as shown.



This table was built up of 4-in. pipe, welded into a complete frame and having a connection for carrying compressed air into the pipe. On the inside was a series of ½-in. holes, illustrated, through which air at high pressure is blown on the hot die that forms four sides. The die is placed on the wire grating inside the pipe frame.

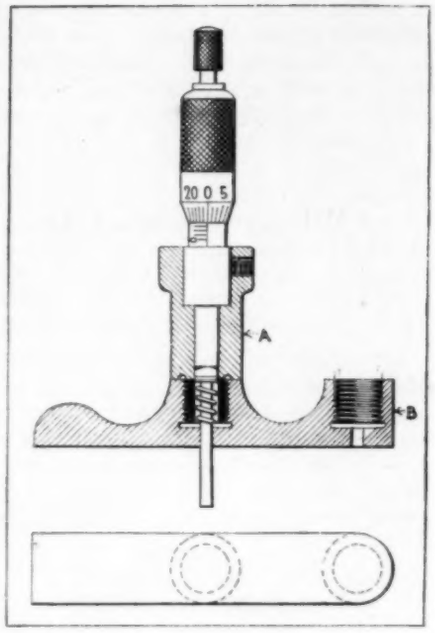
This method of cooling has been found more satisfactory than either oil or water quenching for some of the steels used in the die for heading bolts.

An Improved Micrometer Depth-Gage

WM. C. BETZ

Master Mechanic, The Fafnir Bearing Company

The depth gage illustrated is equipped with a ½-in. micrometer head and a set of contact rods varying in length by increments of ½ in. The micrometer head is held in the sleeve *A*, which can be screwed into either of the tapped holes in the base *B*, one hole being in the center, while the other is at the end of the base. Before the micrometer head is locked in position, the sleeve in which it is held must be screwed tightly against the shoulder at the top of the hole. The height of the shoulders of both holes must, of course, be the same from the bottom of the base to insure accuracy.



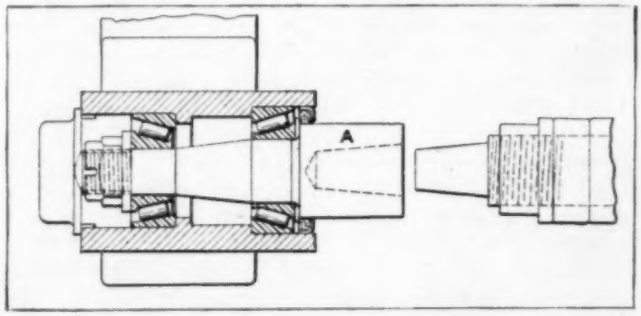
The contact rods have heads at their upper ends and are held in contact with the spindle of the micrometer head by a spring. When the measuring members are in the central hole, the gage does not differ from the ordinary micrometer depth-gage, but when these parts are transferred to the hole in the end of the base, the gage can be used to measure the heights of steps more accurately than can the ordinary micrometer depth-gage. The length of the base gives a long contact surface on the work.

A Roller Bearing Support for Arbors

P. L. BUDWITZ

In our production milling department we have several heavy milling operations to perform. The machines that are engaged in this work were originally equipped with bronze bearings for the outboard supports of the arbors. Bearings of this type often wore out and required frequent replacement. The wear also affects the arbors in a similar manner and sometimes causes arbor breakage.

A bearing unit equipped with roller bearings was constructed, employing practically the same principle as is used in the front wheels of automobiles. Referring to the illustration, the spindle *A* has a taper hole to receive the end of the arbor, which is also tapered, the two tapered surfaces forming a friction drive. They also permit easy removal of the outer bearing for changing the cutters. The wear on this type of bearing is easily



taken up, but tests show surprisingly little wear. The shock and the overload so familiar in heavy milling operations are resisted very well. Grease is used as a lubricant for the bearing.

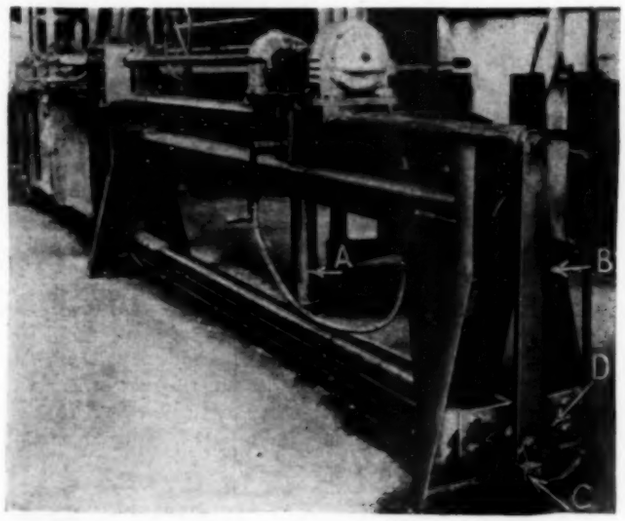
Lining Up With Gravity

CLIFFORD H. FRENCH

The barrels, which contain the sectional linings for oil pump cylinders, have to be accurate as to diameter and straightness in order to hold the liners in proper alignment for smooth working of the plunger. These barrels are lapped for final finish and smoothness, the machine illustrated being designed and built for that purpose by Edward E. Stevenson, of Los Angeles, Calif. The machine is built up from steel plate, welded into legs at each end with ground steel shafting for the guiding numbers and a large tube for stiff form of bed without undue weight. The general construction is shown in the illustration.

The upper shaft supports the carriage that carries the motor and the driving head consisting mainly of a geared speed reducer. The lower shaft guides the carriage through the outer race of a ball bearing in the end of the shaft *A*. The method of securing the alignment or parallellism between the upper and lower shafts is of interest.

Both shafts were accurately centered at each end and tapped for a substantial cap screw. Two bars or links, *B*, were drilled to the center distances between the two bars. The upper shaft was put in place loosely on top of the legs and the lower shaft suspended from it by means of the links and cap screws. With the two shafts free to move and the lower shaft acting as pendulum, the lower shaft was allowed to come to rest directly under the



upper one. A projection on the lower end of the links was surrounded by a free fitting hole in the bar *C*, and after the lower shaft had come to rest, type metal was poured around the projections locking them solidly in position. Then the end plate *D*, bored to fit over the lower shaft, and drilled for four cap screws, was placed in position, the holes drilled and tapped into the legs, and the lower shaft was locked solidly in place.

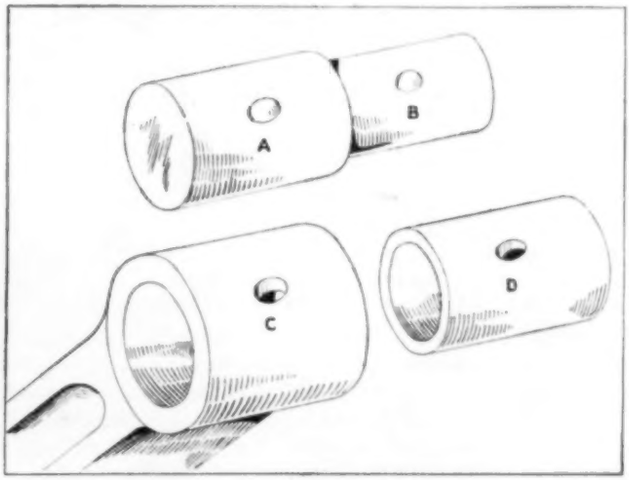
The weight of the carriage is so distributed as to always keep the bearing at the lower end in contact with the lower shaft. There is a rack under the upper shaft by which the carriage can be moved to any point by the handle, and the lap can be fed through the pump barrel that is held in position at the other end. The lower ends of the legs are held together by a substantial I-beam welded in place, one side affording protection for the conduit shown. It will also be seen that the conductor, which supplies current to the motor, comes out of the center of the large tube that forms the bed of the machine with sufficient length to permit movement to either end of the machine.

Guiding Bushings to Make Oil Holes Match

FRANK C. HUDSON

Insuring alignment so that the oil holes in both connecting rod and bushing will match is easily accomplished by the simple guiding plug illustrated. The plug has two diameters, *A* which is a free fit in the rod end *C*, and *B* which fits in the bushing itself. Each end of the plug carries a steel ball that projects beyond the surface and is backed by a coil spring inside the plug. These balls are in line and locate the oil holes in both bushing and rod.

The bushing *D* slips over the plug at *B* and is positioned by the ball sliding into the oil hole. The large end of the plug then goes into the rod until the ball springs



into the oil hole in the end. The rod with the plug and bushing is then placed under an air operated press and the bushing forced into the rod. The plug not only locates the oil holes but also acts as a guide to insure that the bushing gets a proper start in the hole.

Forming Sharp Corners on Shells

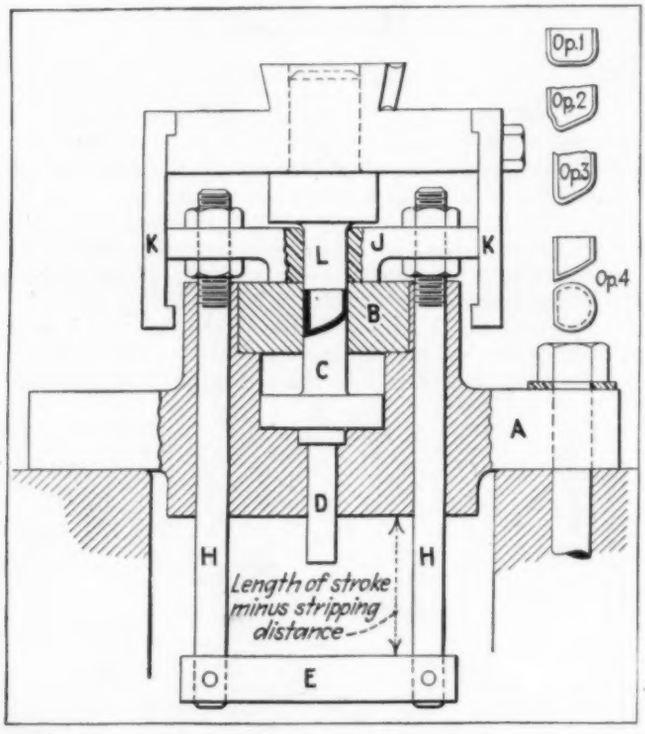
C. S. SCHWAEBLE

Shells such as are shown in the development at the right of the illustration are rather unusual in shape, in that the bottoms are at an angle and the corners are sharp. While operations 1, 2 and 3 are performed in tools of the conventional type, the last or finishing operation is performed in the tools illustrated.

The die shoe *A* contains the die *B* and the sliding

shedder *C*. The shedder is positively bumped up to position by the knockout pin *D*, which derives its motion from that of the plate *E*, the lifter rods *H* and the stripper plate *J*. All of these parts are connected and their motion is controlled by the side arms *K*, which are attached to the punch-holder. The shouldered part of the punch *L* and the hole in the stripper plate are 0.010 in. smaller than the outsides of the shells. This difference in size permits the stripper to engage the shells should they be carried up by the punch.

The material from which the shells are made is sheet brass 0.050 in. thick. If the thickness of the metal is held within a tolerance of 0.001 in., the shoulder on the punch will level up quite an uneven skirt on the shells, but if a



tolerance of 0.004 in. is allowed, the shells may have to be trimmed before the last operation. The light stock will not fill out in the corners and the heavy stock will overfill them, causing fins. If the stock is gaged and each thickness is kept separate, the tools can be adjusted to produce the correct shape, while the slight variations in length will still be within the required limits.

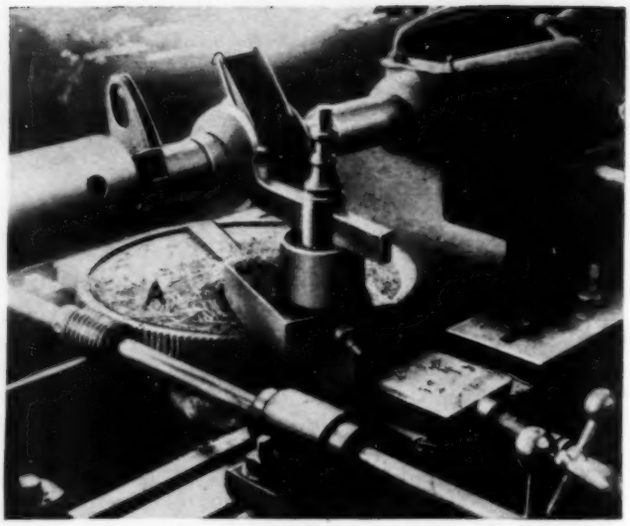
In operation, as the punch descends, its shoulder pushes the shells down into the die, and at the finish of the stroke the end of the punch stamps the bottoms.

Fixture for Turning Spherical Surfaces

AVERY E. GRANVILLE

For the shop machining spherical surfaces as an occasional job, any special equipment must be made as cheap as possible; easily attached to standard machines; and strong and rigid enough to produce duplicate work at any time. The fixture illustrated answers all these requirements.

The turntable *A* is a heavy, cast-iron wormwheel carried on a center bearing in the bridge of the lathe carriage. The toolholder is a regular lathe toolpost and



toolblock, fitted to a short slide on the turntable. Offset tools are used, a left-hand one for one side and a right-hand one for the other side of the spherical surface. The worm through which the turntable is operated is carried on a shaft held in bearings attached to the carriage wings at front and back.

In a fixture of this kind, the parts should be well fitted and the turntable should be supported just under the tool block by a flat pad, in order to insure against chatter.

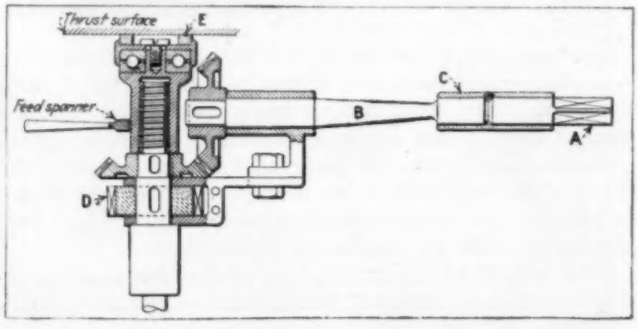
A Dual Ratchet Drill

J. T. TOWLSON
London, England

Practical mechanics will agree that the ordinary ratchet drill possesses valid claims for all around utility, but at the same time they will agree that it is an exceedingly slow device, especially for drilling small holes.

In the illustration is shown a drill that can be used for either intermittent or continuous drilling. For continuous and high-speed rotation, the square *A* on the outer end of the shaft *B* provides means for attaching a crank. On the inner end of the shaft is keyed a bevel gear meshing with a mating gear on the spindle. By turning the crank the spindle will be revolved. The shaft must be held by the hand to prevent it from rotating.

For use as a ratchet drill, the shaft *B* is pushed and pulled in the same way as the lever on an ordinary ratchet is operated, the fiber sleeve *C* being used as a hand grip. This motion rotates the spindle intermittently through the ratchet wheel *D* and a pawl. It will be noted that the shaft *B* and the bevel gear attached to it will be partially revolved by the backward movement of the shaft.

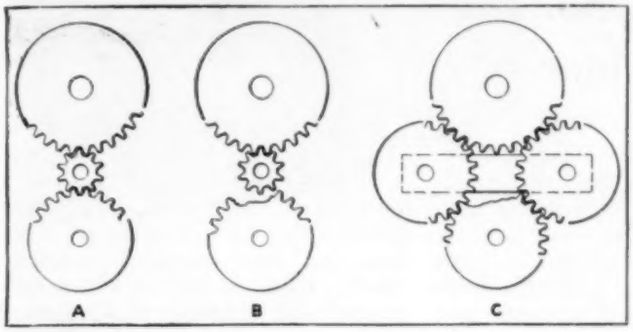


The ball bearing at the top of the feed sleeve is considered to be an advantageous substitute for the usual center. The resilient pad *E* is an advantage that will be understood by all hand drillers.

Keeping a Broken Gear in Service

W. F. SCHAPHORST
Mechanical Engineer

Here is a useful kink—a method by which a machine was kept running in spite of a broken gear. The drive as it was originally is indicated at *A*, there being two gears having an idler pinion between them. A number of teeth in the lower gear and a section of the gear



itself were broken out about as shown at *B*. The broken gear could not be revolved a full turn on account of lack of teeth.

A mechanic ingeniously got around the difficulty by replacing the idler pinion with two idler gears, as shown at *C*. By this means, one or the other of the idlers was always in mesh with the broken gear, consequently the machine was kept going. It so happened that the two idlers used were of the same size, but the same size was not necessary. The only requirements are that their pitch be the same as that of the broken gear and that they be large enough to reach from the upper gear to the unbroken part of the lower gear, just as is indicated in the sketch. The idler gears were tied together by means of the metal strap shown by the dotted lines.

SEEN AND HEARD

JOHN R. GODFREY

How High a Helix?

Automobile manuafcturers have long been concerned with quiet gearing, but even today there is considerable difference of opinion as to how to attain quietness. One car maker in the high priced field advocates helical gears with low helix angles keeping them under 20 degrees. He claims that this practice gives him satisfactory performance despite the criticism of the high helix school of gear designers.

Another quality car manufacturer uses helix angles up to 45 deg. and believes that the high angle aids in producing quiet gearing. No doubt other factors are just as important as the helix angles, but it would seem that there is still much to be learned on this subject.

Burning Slots in Oil Well Pipe

Cutting slots in oil well pipes to act as strainers for oil pumps is one of the latest applications of the cutting torch. Instead of trying to mill these slots as formerly, a new special machine cuts slots of any width from thirty-thousandths in width up to any width desired. It cuts slots of any length and at any desired distance apart. The gas jets or nozzles are interestingly made, are interchangeable, and built in a small turret so that a new jet can be swung into place while one of the others is being cleaned. The slots are cut smoothly and preferably with about a six-degree taper toward the inside. It is the smoothest cutting I have ever seen, and the machine is semi-automatic. It drills a starting hole at the end of each slot and leaves the other end of the slot rounded in a similar way by the shape of the jets used. Any one who has a slotting problem might look into the method used in this case.

Vibration and Chatter

Vibration is an enemy of smooth machining just as it raises hob with the cutting edges of tools. And the more brittle the cutting material the worse for the tool. When it comes to the work itself, vibration produces chatter marks and becomes quite a problem in turning or boring thin metal. One of the turning jobs of my apprentice days was a thin cast brass piece, shaped like a funnel, and chatter was avoided by stuffing the inside full of waste to prevent vibration. The other day I saw this reversed in boring a thin brake drum in a service station. A piece of leather belt was wrapped around the outside of the drum and held with a coil spring. The combination made it easy to get a smooth cut.

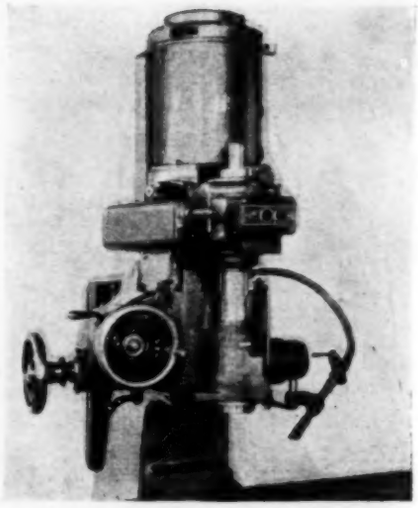
Now They Stamp 'Em

One of the features of the recent New York automobile show was the number and variety of neat metal stampings which have almost completely displaced the woven wire grills for covering radiator fronts that were popular a year ago. Many of these are made in one piece and suggest a new outlet for parts made in the stamping shop. A majority have a vertical bar effect produced by slotting the metal and afterward drawing it into final form so that what appear to be bars are really U-shaped strips of sheet metal.

In some cases, these strips are straight and in others they are curved outward at the bottom. Many are chromium plated and polished, but others are lacquered or enameled and in some instances have hair-line striping. Beading forms the outer rim of the grill and sometimes a center bead is stamped integral, and fits the radiator shell closely. Chevrolet and Pontiac grills are flat and fit close against the core of the radiator. They appear to have been stamped in a lattice and then to have been folded in such a way that the vertical members stand forward and are joined by depressed transverse members. These seem to be a part of the core although they are independent of it. The forward edges of the verticals are polished.

Stamping shops equipped to do this class of work doubtless can find variations of present designs that will open up new business, and there should be some market for false fronts or grills that could be applied to cars now in service and whose owners wish to bring them up to date.

SHOP EQUIPMENT NEWS

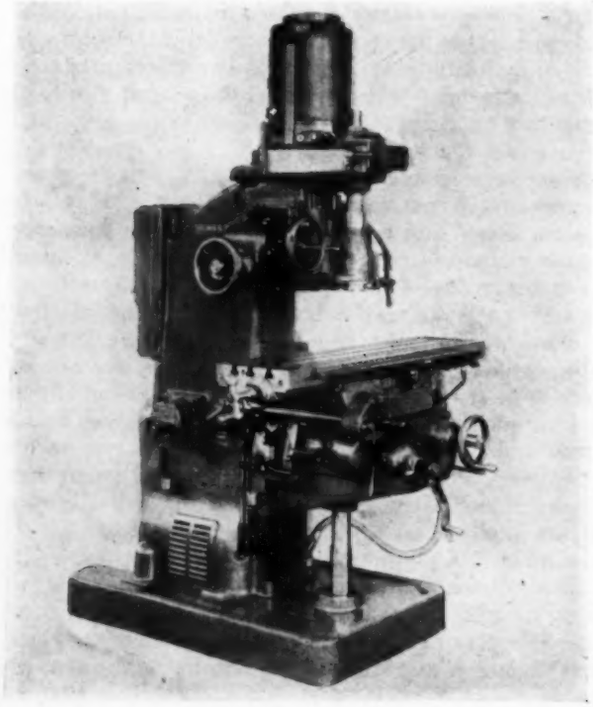


Brown and Sharpe "Standard" No. 1 Vertical Spindle Milling Machine

THE Brown & Sharpe Mfg. Co., Providence, R. I., has added a No. 1 Standard vertical spindle milling machine (motor-driven) to its line of "Standard" machines. The new machine provides a fast, sensitive unit for end mills and shell end mills, through spindle speeds ranging from 150 to 1,800 r.p.m. in either direction. The high-speed series gives correct speeds when using small end mills from $\frac{1}{8}$ to 3 in. in diameter of the new cutting alloys as well as of high-speed steel. The back-gear range to 450 r.p.m gives a more powerful drive for large cutters.

The machine is provided with a new type of motorization, an individual motor being used to drive the spindle, while a second motor furnishes power for table and spindle feeds. Both motors are controlled from a single pushbutton station accessible from either front or rear operating positions. All electrical controls and wiring are inclosed.

Cutting movements of both table and spindle can be controlled from either front or rear operating position. Feed changes of table and spindle and speed changes can be made similarly. Practically all construction elements of the regular line are included in the new machine, including the dual operating control (changing as well engagement of speeds and feeds from front or rear operating position), power fast travel for the table in all directions (automatically disengaged when not in use), anti-friction bearings in all main mechanisms including spindle drive, automatic lubrication, unit-type coolant pump, and convenient hand adjustments of table, saddle and spindle.

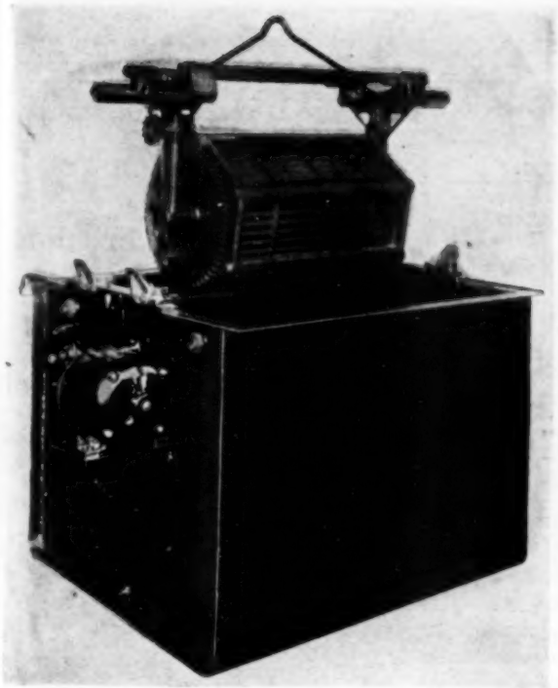


Two motors, one to drive the spindle, the other to furnish power for table and spindle feeds, are used in this B & S vertical milling machine. Both are controlled from one push button

A fast, flexible speed change is available for the speed motor through a drum-type control and back-gear lever located at the left front of the spindle head and usable from either front or rear operating position. Power feed is provided for the spindle head which can be disengaged readily when not in use. In addition, an unusually fast hand adjustment of $2\frac{1}{16}$ in. per revolution of the handwheel is available, so that less than two turns of the handwheel will move the head the entire length of its travel. As the head is conterweighted, this adjustment is made easily. Longitudinal hand control is provided with a newly designed safety handwheel, automatically disengaged when not in use. The handcrank gives the advantage of long leverage, or the handwheel can be "rimmed" when it is desired to make delicate adjustments. A 12-page bulletin on the machine is available from the company.

"National" Hard-Rubber Cylinder Plating Barrel

"National" plating machinery, manufactured by National Steel Products Co., Dayton, Ohio, supersedes the "Crown" line manufactured by the same company. It is now being marketed by Udylite Process Co., Detroit, Mich. Barrel-type plating machines are now available in bale and lift-arm types incorporating several new design elements. Construction has been simplified so far as possible. Tanks are of double-welded sheet steel pre-tested for leakage and protected against corrosion. Tanks are equipped with insulated anode bars of large current-carrying



Double-welded sheet steel tanks and hard-rubber cylinders are used in the National plating barrel

capacity and insulated brass cathode contacts. Provision is made for exact automatic location of cylinder contacts in cathode contact saddles. Anode bars and cathodes are connected by flat busbars seated and protected against corrosion at points of juncture. Lined cypress tanks or rubber-lined steel tanks can be provided if preferred. Tanks will be equipped with heating or cooling coils or provision made for their application if specified.

The cylinders are suspended in cast hanger frames with cathode connecting points cast integral. These become electrical connections when the cylinder is in the operating position. The hanger has two contacts on the drive end and on the opposite end only one, giving the assembly a three-point suspension. Removal of two standard hex nuts permits disassembly of the entire hanger mechanism. The lower end of the bronze hanger frame becomes the cylinder shaft bearing and is insulated to a point above the solution line with molded hard rubber. Driving pinions and shafts are carried in the hanger in constant mesh with the main cylinder drive gear. When the cylinder is in position, the drive pinion meshes automatically with the motor pinion. Tie and spacer rods with a suitable lifting eye complete the assembly.

In the lift-arm type the cylinder is carried between insulated arms which act as current conductors. These arms are mounted on a heavy shaft carried in bearings and worm-and-gear drivers. All parts are insulated where necessary. The design is adaptable to plants desiring a self-contained operating unit.

Direct-connected individual motor drives are standard. Motor and primary speed reducers are built as a single unit. This avoids clutches and the former shifting mechanism. Belt drive will, however, be installed if specified.

Panels are fully supported in the rail slots for their entire length. They also enter slots in the heads to gain better end supports. The door panel is supported its full length in the rail slot on one side and by friction controlled locking bars on the opposite side. Locking latches are secured to the door panel which prevents loss while the cylinder is in operation. The standard hard-rubber cylinders are equipped with short shafts at each end with wheel-type danglers. These danglers have insulated hubs and spokes which may be removed easily for stripping and replacing. A through shaft and hairpin type danglers can be furnished if preferred. Cylinders made from Formica or Micarta will be furnished if requested.

Wel-Don Hollow-Ground End Mills

Double-ended end mills with hollow-ground lips are being manufactured by Weldon Tool Co., 1426 West Third St., Cleveland, Ohio. Advantages claimed for the double-end design are fewer delays for regrinding and lower first cost. Easy reversal is obtained by using a straight, rather than tapered, shank, which is a close sliding fit in the toolholder and is held in place by a setscrew in the holder locking on the flat in the center of the mill shank. Straight construction of the shank eliminates drifting, and is claimed to insure true running of the mill. The "hook" effect of the hollow-ground lips curls and ejects the chips. Mills are available with left- or right-hand cut and left- or right-hand spiral.

Toledo Torque Dynamometer

A torque dynamometer scale has been introduced by Toledo Precision Devices, Inc., Toledo, Ohio, to register the stalling torque of motors. It has thus far been adapted only to measuring the stalling torque of starting motors for automobiles but can be used for measuring torque of machine tool or other motors and drives. Its cycle of operation takes approximately 15 sec.

The dynamometer is designed for mounting on a bench and a cradle for the motor to be tested is placed adjacent to it. In testing, the shaft of the motor is placed in alignment with a horizontal arm extending out from the dynamometer. After the motor is clamped in position by an eccentric, the sliding coupling on the horizontal arm is pushed over the shaft of the motor. The clamping device engages

with a keyseat in the end of the motor shaft. Current is then applied to start the motor, though revolution is prevented by the dynamometer arm. Downward pressure on the arm registers on the dial, and the operator reads the stalling torque.

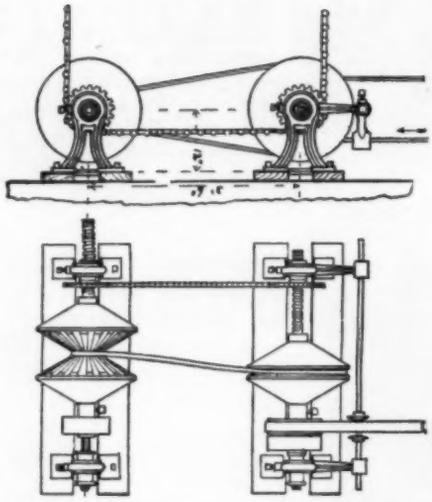
Techno Pressure Oiler

A simple portable pressure-type spray oiler is being manufactured by Techno Products Co., 7523 Santa Fe Ave., Huntington Park, Calif. The body of the oiler, an aluminum casting, is shaped to afford a comfortable grip and is equipped with an easy-action trigger for thumb operation. An extra long adjustable nozzle provides one-hand oiling with safety. The unit utilizes air to create its pressure, the air being supplied by hand pump or other pressure outlet. The trigger action can be regulated by a fluid valve to provide any degree of spray from a high-pressure stream to a

drop. Brass fittings provide a rust-proof unit. In the photograph the hand pump may be seen extending about the trigger with the fluid adjustment extending to the right. The packing gland is easily accessible just to the left of the fluid adjustment. The unit can be used for providing lubrication for temporary threading, cutting or drilling set-up. A variety of nozzles are available.

Buffalo Variable-Speed Countershaft

A variable-speed countershaft that may be powered directly by a motor or driven from a lineshaft has been announced by the Buffalo Gear & Pattern Works, 18-20 Elk St., Buffalo, N. Y. This drive can be hung from the ceiling in the usual way or can be set on the floor. It will be seen from the accompanying illustra-



tion that a leather belt connects the two separable-face pulleys. The pulleys are mounted with one half fixed on the shaft and the other half capable of displacement along the screw. Shifting the movable half of each cone changes the effective driving diameter so that the speed can be changed. A Link Belt chain running over sprockets on the two shafts affords means for varying the effective diameters of each pulley simultaneously.

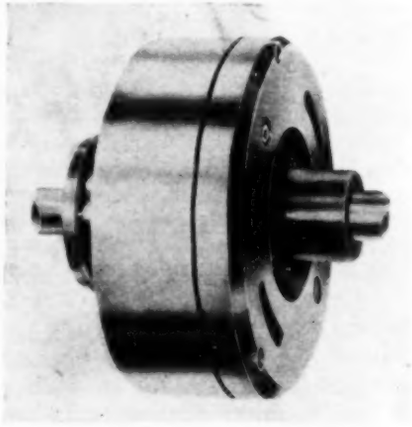
Wagner Type RG Repulsion-Induction Motor

The Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo., has developed the Type RG repulsion-induction motor, which has a smooth speed-torque curve throughout the operating range. The motor possesses the following features: low starting

current, close speed regulation, positive operation on low voltage, high power factor, good commutation, and no internal short-circuiting or brush-lifting mechanism. Bolt holes are evenly spaced, permitting 90 and 180 deg. rotation of endplates for wall and ceiling mounting. As shown, the covers are hinged to the endplate and are fastened in place by small screws. A large-sized blower assures positive ventilation of the motor.

Dings Magnetic Friction Clutch and Clutch Coupling

Two products, a magnetic friction-type clutch and a magnetic clutch-coupling, have been announced by the Dings Magnetic Separator Co., Milwaukee, Wis. The friction clutch has contact faces on both sides of a spring disk, which is squeezed between the magnet and armature elements when the coil is energized. Power transmission of this clutch is approximately 75 per cent greater



than that of a single-face clutch. The physical dimensions are small.

Provisions are made in the clutch for adjustment to compensate for wear of the contact faces. Light springs on the armature holding bolts serve to expel the armature when the coil is de-energized, giving ample clearance. The clutch is made with and without ball bearings between the hubs of the two clutch members as installation conditions require. In addition, the company is manufacturing a single-spring disk clutch following the same general construction but having three friction contact faces, and consequently giving increased power transmission.

The magnetic clutch-coupling, although installed previously in connection with mill screwdowns, can be applied wherever synchronizing the speeds of two power drives is required. Serrated contact faces are used in this clutch coupling to prevent

creeping of the contact faces. The contact face serrations are V-shaped. Physical dimensions are said to be less than those of a friction-type clutch of lower torque rating.

Tornado Model 4 Portable Electric Blower

Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago, Ill., is manufacturing a Tornado Model 4 portable electric blower for blowing dust out of motors and machinery parts,

vacuum cleaning stock rooms and bins, and for spraying volatile material. The blower is almost identical in design and construction to the larger heavy-duty Tornado blowers.

"Nevastain RA" Alloy Steel

An alloy steel that is fabricated by the same methods and equipment as mild steel is now in production by the Associated Alloy Steel Co., Cleveland, Ohio. Developed by the Ludlum Steel Co., this "Nevastain RA" is said not to work harden to the same extent as usual for the stainless steel alloys. Therefore, it will cold roll, draw, upset and form with less mechanical trouble. It also does not require high temperature heat-treatment for annealing or to relieve forging or drawing strains. It is free machining, and is also susceptible to fabrication by gas or electric arc, flash or spot welding without tendency to grain growth. The material polishes to a high lustre with a blue-white color.

Analysis of Nevastain RA is as follows: Carbon, maximum 0.10 per cent; manganese, 0.40; chromium, 16; silicon, 1; copper, 1; and phosphor and sulphur, 0.030. Specific gravity is 7.67. Average tensile properties for hot rolled bar stock are: ultimate strength, 100,000-130,000 lb. per sq. in.; yield point, 50,000-70,000; elongation, 17-25 per cent in 2 in.; reduction of area, 45-65 per cent in 2 in.; hardness 220-260 Brinell.

• EQUIPMENT ADAPTATIONS •

Recently Developed by the Makers

Avey Special-Purpose Cylinder-Block Drilling Machines

Typical of drilling and tapping machines furnished to the automotive industry by The Avey Drilling Machine Co., Cincinnati, Ohio, are the three special-purpose machines illustrated. These machines are used for drilling and tapping cylinder blocks and head liners, but standard Avey motor units are used in their construction. The cylinder block machines, Figs. 1 and 2, are electrically controlled from the front and have a tell-tale light to show when the tools have cleared. Air is used as a booster to provide quick advance to the spindles. The blocks pass through the machines from left to right on rollers. Disappearing locators are used when the block comes through in its normal position, but when inverted it is raised onto permanent locators at the top of the fixture. Miscellaneous oil holes are drilled. Blocks are passed through the machine at the rate of 30 per hr.

In Fig. 3 is shown a machine for drilling and tapping water connection holes in both ends of straight-eight and V-type twelve-cylinder heads. The front unit drills and the rear unit taps, the holding fixture

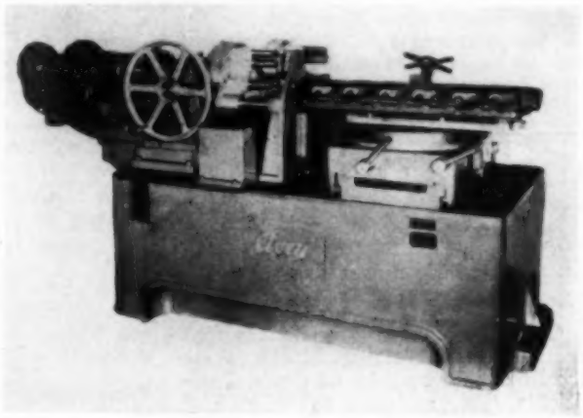
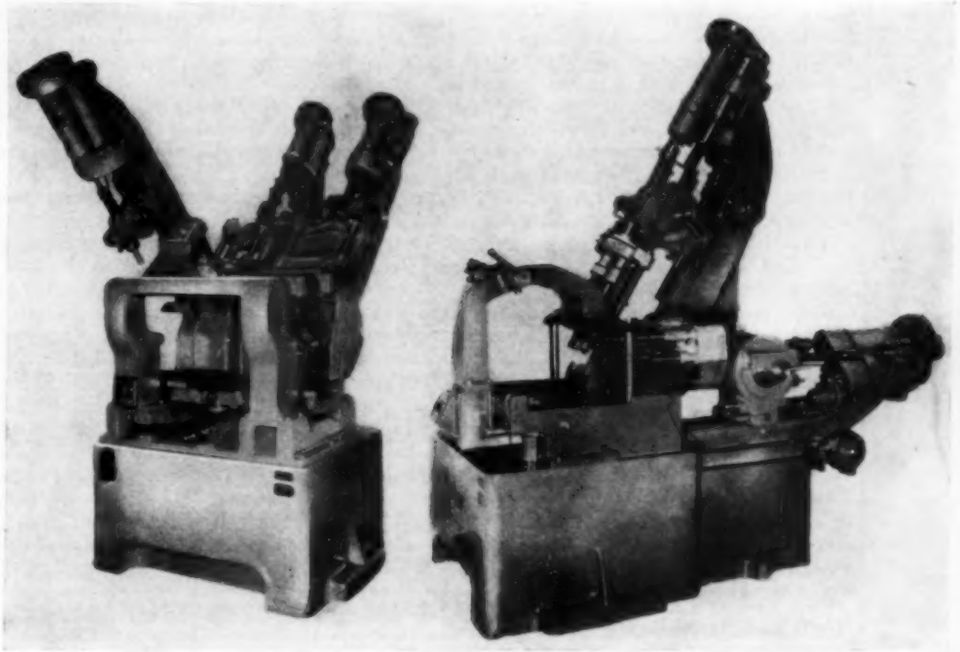


Fig. 3—Water connection holes in both ends of straight-edge and V-type twelve-cylinder heads are drilled and tapped in this Avey special-purpose machine



Figs. 1 and 2—Miscellaneous oil holes are drilled in cylinder blocks by these Avery special-purpose machines which use standard motor units

being provided with both sliding and rotary movement. The extra spindles in the multiple heads are for cylinder heads with holes located differently from those in the head to be seen on the machine.

• TRADE PUBLICATIONS •

TESTING MACHINES. Bulletin No. 28, of Baldwin-Southwark Corp., Philadelphia, Pa., describes the Southwark-Emery Testing Machines, including the new 4,000,000-lb. universal unit for University of California. The bulletin is extensively illustrated and includes a historical sketch of the development of testing machines, a discussion of the various parts and types of machines, and also an explanation of the new Southwark-Emery stress strain recorder.

• PATENTS •

MARCH 29, 1932

Metal Working Machinery

Guide Mechanism For Use in Connection With Welding Machines and the Like. James Edward Coyle, Philadelphia, Pa., assigned to Edward G. Budd Manufacturing Co. Patent 1,851,001.

Shaping Machine (Contour Lathe). John Shearman Donaldson, New York, N. Y. Patent 1,851,004.

Hydraulic Press. Frank H. Smith, Cleveland, Ohio, assigned to Southwark Foundry & Machine Co. Patent 1,851,138.

Tube Cutting and Flaring Machine. John W. Gordon, Dayton, Ohio, assigned to the Gordon-Dunnam Manufacturing Co. Patent 1,851,276.

Machine Tool. William C. Heath, Beloit, Wis., assigned to Fairbanks, Morse & Co. Patent 1,851,310.

Threading Machine. Erik W. Mikaelson, Easton, Pa., assigned to Treadwell Engineering Co. Patent 1,851,367.

Pipe Welding Device. Carl G. Jones, Wilkinsburg, and Lewis R. Smith, Edgewood, Pa., assigned to Westinghouse Electric & Manufacturing Co. Patent 1,851,517.

Grinding Machine. Henry L. Crowley, East Orange, N. J., assigned to Henry L. Crowley & Co. Incorporated. Patent 1,851,566.

Structural Steel Working Machine. Theodore Kaseberg, Granite City, Ill., assigned to the American Car & Foundry Co. Patent 1,851,845.

Tools and Attachments

Quick-Operating Workholding Device. Cyril A. Fox, Oakmont, Pa. Patent 1,851,041.

Undercutter Attachment For Flexible-Shaft Bench Grinders. William Krause, Bronx, N. Y., assigned to Pratt & Whitney Co. Patent 1,851,284.

Releasable Shaft-Rotating Device. Robert T. Hazelton, Cincinnati, Ohio, assigned to The Cincinnati Shaper Co. Patent 1,851,307.

Safety Adjustable Cutting Torch. Thomas Samuel Taylor, Bartonville, Ontario, Canada. Patent 1,851,377.

Gear Shaping Mechanism. Joseph L. Matthews, New Brunswick, N. J., assigned to International Motor Co. Patent 1,851,397.

Lathe Chuck. Earl J. Preston, William C. Fletcher, and Albert W. Reynolds, Jr., Princeton, W. Va.; said Fletcher assigned to said Preston. Patent 1,851,403.

Feeding Device For Strip Materials. William W. Carson, Jr., Knoxville, Tenn., assigned to The Fulton Sylphon Co. Patent 1,851,420.

Chuck. Richard F. Russell, Elmira, N. Y. Patent 1,851,525.

Welding Apparatus. Verni J. Chapman, Schenectady, N. Y., assigned to General Electric Co. Patent 1,851,563.

Rotary Cutter. Hugh M. Albee, Orange, Mass., assigned to the Leavitt Machine Co. Patent 1,851,613.

Shank and Bit Punch. Jesse Ditson, Littleton, and Dudley W. Hart, Denver, Colo., assigned to Ingersoll Rand Co. Patent 1,851,620.

Atmospheric Control For Heat-Treating Furnaces. Carl I. Hayes, Providence, R. I. Patent 1,851,831.

Processes

Metal Blank and Method of Forming Same. John P. Tarbox, Philadelphia, Pa., assigned to Edward G. Budd Manufacturing Co. Patent 1,851,023.

Method Of Making Pipe Couplings. John D. Baldwin, Jr., Cleveland, Ohio, assigned to Albert J. Weatherhead, Jr. Patent 1,851,031.

Extrusion Rolling. George Ramsey, Brooklyn, N. Y. Patent 1,851,063.

Method Of Making Pipe Plugs. Harrington Moore, Medford, and Walter H. Grinnell, Danvers, Mass. Patent 1,851,127.

Process of and Means for Magnetically Controlling Welding Arcs. Lennart Andren and Robert Patterson, Bridgeport, Conn., assigned to American Chain Co. Inc. Patent 1,851,479.

Process of Carbonizing Metals. Howard M. Elsey, Oakmont, Pa., assigned to Westinghouse Electric & Manufacturing Co. Patent 1,851,573.

Process of Treating Metals. Floyd J. Metzger, New York, N. Y., assigned to Air Reduction Co., Inc. Patent 1,851,861.

Heat-Treatment Of Cold Shaped Manganese Steel Articles. John Howe Hall, High Bridge, N. J., assigned to Taylor-Wharton Iron & Steel Co. Patent 1,851,903.

Method of Finishing Metalware. Andrew L. Fabens, Wooster, Ohio, assigned to the Buckeye Aluminum Co. Patent 1,851,932.

Means for Die Casting. Berger Stockfleth, Niles, Mich., assigned to Hydraulic Pressed Bearing Co. Patent 1,851,935.

Furnaces

Heat-Treating Apparatus. Edward A. Lange, Blue Island, Ill. Patent 1,851,913.

Strength of External Spur Gear Teeth

DOUGLAS T. HAMILTON
Advertising Manager,
Fellows Gear Shaper Company

On the following two pages, and on the first Reference Book Sheet page next week, are presented three tables and charts presenting the x factor commonly associated with the Lewis formula for determining the strength of gear teeth. They cover the 14½-deg. full-length teeth, 20-deg. involute full-length teeth, and 20-deg. involute stub teeth. I believe the arrangement will be found complete and convenient. We have had many calls for this data and find that many engineers are not using Mr. Lewis' Y value, but are using our data, giving the x value obtained from calculation from accurately generated gear tooth forms.

Originally, Wilfred Lewis, when he devised his formula, used the value Y obtained by the following formula: $Y = 2x/3P$. As the circular pitch enters into the calculation in determining the value of x, there is no need of reintroducing it. We, in our formula, have therefore eliminated the circular pitch entirely. The formula for tangential tooth load is equal to SFS times the face width times $2x/3$. This makes a condensed simple formula.

Other elements of the Lewis formula that were rough approximations, were the values given for Y. These, Mr. Lewis told me, were obtained by graphical means, and thus are far from accurate. Again, they applied only to gears produced by a form milling cutter, consequently show a considerable excess of strength over a gear produced by a generating cutter such as a hob or gear shaper cutter. In other words, the fillet as generated by a hob or gear shaper cutter, especially on small numbers of teeth, has considerable undercut. Mr. Lewis did not take this into consideration, but considered the flank as radial. Thus, many engineers are now using the x value as given in these tables instead of the Y of the Lewis formula.

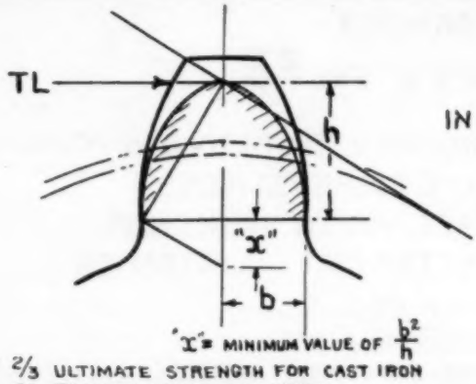
American Machinist

Reference Book Sheet

STRENGTH OF EXTERNAL SPUR GEAR TEETH

Values of *X* for 20-deg. Involute Full-length Teeth

(AS BASED ON LEWIS FORMULA)



"x" = MINIMUM VALUE OF $\frac{b^2}{h}$

* 2/3 ULTIMATE STRENGTH FOR CAST IRON
2/3 ELASTIC LIMIT FOR STEEL

FORMULA:

$$TL = SFS \times FW \frac{2x}{3}$$

IN WHICH:

TL = TANGENTIAL TOOTH LOAD IN POUNDS
SFS = SAFE FIBRE STRESS
FW = FACE WIDTH IN INCHES
"x" = FACTOR (SEE ILLUSTRATION)

$$SFS = \frac{*FS \times 600}{600 \times PLV}$$

FS = FIBRE STRESS OF MATERIAL
PLV = PITCH LINE VELOCITY IN FEET PER MIN.

NUMBER OF TEETH	DIAMETRAL PITCH													
	2	3	4	5	6	7	8	9	10	12	14	16	18	20
	VALUE OF "x" IN INCHES													
12	.1770	.1180	.0885	.0705	.0590	.0505	.0445	.0390	.0350	.0280	.0245	.0220	.0195	.0180
13	.1870	.1246	.0935	.0745	.0623	.0534	.0469	.0411	.0370	.0298	.0259	.0232	.0205	.0190
14	.1977	.1318	.0988	.0788	.0659	.0565	.0496	.0435	.0391	.0317	.0275	.0246	.0218	.0200
15	.2050	.1366	.1025	.0817	.0683	.0585	.0514	.0452	.0405	.0330	.0286	.0255	.0225	.0208
16	.2105	.1403	.1052	.0838	.0702	.0600	.0528	.0464	.0416	.0339	.0294	.0262	.0232	.0213
17	.2160	.1439	.1080	.0860	.0720	.0616	.0541	.0477	.0427	.0349	.0302	.0268	.0238	.0219
18	.2227	.1484	.1112	.0887	.0742	.0635	.0558	.0492	.0440	.0360	.0312	.0278	.0246	.0226
19	.2300	.1533	.1150	.0918	.0767	.0657	.0576	.0508	.0455	.0374	.0323	.0287	.0255	.0234
20	.2385	.1588	.1191	.0952	.0794	.0680	.0596	.0526	.0472	.0388	.0333	.0297	.0264	.0242
22	.2477	.1650	.1236	.0989	.0824	.0706	.0619	.0547	.0490	.0403	.0348	.0308	.0274	.0251
24	.2564	.1707	.1280	.1029	.0853	.0731	.0641	.0567	.0507	.0418	.0360	.0319	.0284	.0260
28	.2629	.1750	.1312	.1050	.0870	.0749	.0657	.0581	.0520	.0429	.0370	.0328	.0291	.0267
32	.2739	.1823	.1367	.1094	.0910	.0780	.0684	.0606	.0543	.0449	.0386	.0341	.0304	.0278
35	.2825	.1881	.1410	.1129	.0940	.0805	.0705	.0626	.0560	.0464	.0399	.0352	.0314	.0287
40	.2908	.1936	.1457	1163	.0968	.0829	.0726	.0644	.0577	.0479	.0410	.0363	.0323	.0295
60	.2994	.1993	.1494	.1197	.0996	.0854	.0747	.0664	.0595	.0494	.0423	.0374	.0333	.0304
80	.3096	.2062	.1545	.1238	.1030	.0883	.0773	.0686	.0615	.0511	.0437	.0386	.0345	.0315
110	3222	.2145	.1608	.1288	.1072	.0920	.0804	.0714	.0640	.0533	.0456	.0401	.0359	.0328
150	.3309	.2204	.1657	.1324	.1101	.0949	.0825	.0734	.0658	.0549	.0469	.0412	.0369	.0336
200	.3407	.2269	.1700	.1363	.1134	.0972	.0850	.0756	.0678	.0566	.0483	.0425	.0380	.0346
RACK	.3485	.2320	.1740	.1395	.1160	.0995	.0870	.0775	.0695	.0580	.0495	.0435	.0390	.0355

Courtesy of Fellows Gear Shaper Company

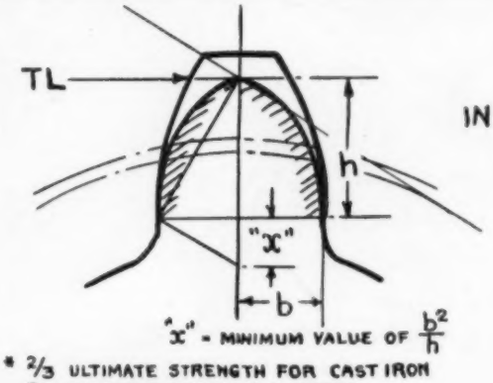
American Machinist

Reference Book Sheet

STRENGTH OF EXTERNAL SPUR GEAR TEETH

Values of *X* for 20-deg. Involute Stub Teeth

(AS BASED ON LEWIS FORMULA)



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NUMBER OF TEETH	DIAMETRAL PITCH												
	3/4	4/5	5/7	6/8	7/9	8/10	9/11	10/12	12/14	14/18	16/21	18/24	20/26
	VALUE OF "x" IN INCHES												
12	.1850	.1205	.1160	.0890	.0720	.0610	.0520	.0465	.0389	.0360	.0312	.0267	.0235
13	.1905	.1254	.1195	.0921	.0748	.0634	.0542	.0485	.0402	.0374	.0323	.0279	.0246
14	.1968	.1305	.1232	.0954	.0775	.0659	.0566	.0506	.0417	.0387	.0335	.0292	.0258
15	.2010	.1348	.1258	.0976	.0795	.0676	.0582	.0520	.0428	.0397	.0344	.0302	.0267
16	.2041	.1368	.1277	.0992	.0809	.0689	.0594	.0531	.0436	.0404	.0350	.0308	.0273
17	.2073	.1394	.1297	.1010	.0823	.0702	.0606	.0542	.0443	.0411	.0357	.0315	.0279
18	.2113	.1427	.1320	.1030	.0841	.0717	.0621	.0555	.0453	.0419	.0364	.0323	.0287
19	.2156	.1463	.1346	.1053	.0861	.0735	.0638	.0569	.0464	.0429	.0373	.0333	.0297
20	.2204	.1503	.1375	.1078	.0884	.0754	.0656	.0585	.0475	.0440	.0383	.0343	.0305
22	.2258	.1548	.1409	.1106	.0909	.0776	.0676	.0604	.0488	.0452	.0393	.0355	.0315
24	.2307	.1590	.1439	.1136	.0932	.0796	.0695	.0622	.0500	.0463	.0402	.0365	.0325
28	.2345	.1621	.1462	.1157	.0949	.0811	.0708	.0634	.0508	.0477	.0410	.0373	.0332
32	.2410	.1674	.1500	.1185	.0978	.0837	.0733	.0656	.0524	.0486	.0422	.0387	.0345
35	.2460	.1717	.1531	.1212	.1002	.0857	.0752	.0674	.0537	.0497	.0432	.0398	.0355
40	.2509	.1757	.1560	.1237	.1024	.0877	.0771	.0690	.0548	.0509	.0442	.0407	.0365
60	.2558	.1798	.1590	.1264	.1047	.0897	.0790	.0706	.0561	.0520	.0452	.0418	.0374
80	.2619	.1848	.1628	.1295	.1075	.0922	.0812	.0727	.0575	.0534	.0465	.0431	.0386
110	.2692	.1909	.1672	.1334	.1109	.0952	.0841	.0752	.0593	.0550	.0479	.0447	.0400
150	.2743	.1953	.1702	.1361	.1133	.0973	.0860	.0770	.0605	.0562	.0489	.0458	.0410
200	.2800	.2000	.1738	.1391	.1159	.0996	.0882	.0790	.0619	.0574	.0501	.0470	.0421
RACK	.2845	.2040	.1765	.1415	.1180	.1015	.0900	.0805	.0630	.0586	.0510	.0480	.0430

Courtesy of Fellows Gear Shaper Company

EDITORIALS

April 7, 1932

K. H. CONDIT • F. H. COLVIN

Editors

Does Revamping Pay?

Held down rigidly by the type of financial management that approves the spending of thousands for repairs and revamping but forbids spending a cent for new machines, many a desperate tool supervisor or superintendent has made an old machine serve by putting on new heads. This practice may seem to lead to immediate economies but it is also a prolific source of trouble.

Not long ago a revamped machine was put into an automobile production line. It was the only machine available for making a certain part, four of which were required per car. One day it broke down, badly. Production stopped until hurried arrangements to make the parts by hand were completed. By the time the machine was ready to run again, enough money had been spent on hand work to buy two new machines.

Revamp if you must, but do it with your eyes open to the danger, and be sure that the financial heads know what failure of the machine will cost.

Stocks and Standards

Reduction of inventory of expense material such as small tools and grinding wheels is an outstanding characteristic of present manufacturing policy. Companies that formerly carried inventories measured in hundreds of thousands of dollars are getting along today with but a tenth as much. They have discovered that reduced production schedules permit some reduction, and that the supply houses can be made to carry the rest.

The latter discovery bodes ill for the supply men. Unless human nature changes, they are pretty certain to have to continue the bag-holding process after business recovers. Such being the case, they should certainly take a keen interest in any means of reducing their own inventory burden. Simplification or standardization of drills, taps, reamers, grinding wheels and other such items gains added importance when the effect on the pocket book is so immediate and so severe.

Greener Pastures

As the depression continues its way in business and industry, there is considerable evidence accumulating that manufacturers are tending to jump over into the pastures of fellow manufacturers and begin the making of products not before attempted. That this should be done is not strange since practically everyone finds it difficult to fill his shop with sufficient work to keep his organization intact. In many respects this is a laudable policy, for to keep intact an organization of loyal people developed over a period of years has very definite social implications. From the individual and social points of view, however, there are considerations which may seriously question the advisability of so doing.

In the first place, what may be to the immediate advantage of one shop may be at the loss of another, and the net result, from a broad point of view, be nil. It represents a jockeying for position in the industrial field with no tangible effect on the total of employment, and in many cases represents a disrupting influence on the orderly progress of industry.

Again, for the individual manufacturer the policy may be freighted with danger. When an established manufacturer of hand tools producing efficiently and selling with a normal and reasonable profit an item for $1.25, finds a new competitor taking the business at 80 cents, employment in the first case is adversely affected and the ability of the second to continue at the 80 cent price is to be seriously questioned. The addition of new products always involves expensive research and

production adjustments, the cost of which is difficult to approximate. In times of strain, as at present, it would seem the point of wisdom to protect existing reserves by refusing to gamble on ventures which are not a part of and closely integrated with present products, and possible of manufacture with existing equipment.

Finally, the kind of new products attempted should be very carefully selected with a view to the character of work which the existing organization has been in the habit of doing. To introduce a production job into a precision shop is bound to result in excessive costs; the organization is tuned for precision work and is unable to adjust to the new requirements. The reverse of these conditions affords practically the same results, the difference being that in the first case excessive labor costs will result, and in the latter excessive spoilage.

• CHIPS •

Budget-balancing or not, the tax bill has achieved a change of venue . . . Senators now choose up sides for the national tug-of-war between the sales-tax and soak-the-rich factions . . . Some are concerned about getting out of the capitol in time for party conventions . . . One upper house committee considers move to ease anti-trust laws . . . another contemplates $500,000,000 bond issue for immediate completion of rivers and harbors projects . . . Reserve Board joins critics of Glass bill . . . Proponents retaliate with inquiry into bankers' lobby . . . President predicts irretrievable undermining of credit if bonus handout to veterans is passed . . . warns he will veto $2,000,000,000 bill if it reaches him . . . Reconstruction Finance Corporation is loath to take over bag that banks have been holding for the railroads . . . but $4,399,000 loan to New York Central demonstrates readiness to finance new construction . . . Pennsylvania now wants $55,000,000 for electrification.

Bank suspensions down 30 per cent in week . . . 22 per cent in month . . . Carloadings reach new 1932 peak . . . Railroad earnings show upward trend for first time in two years . . . cause, wage cut and rate rise . . . Living costs at lowest point in fourteen years . . . 1923 dollar now worth $1.25 when spent . . . Myron C. Taylor, succeeding J. P. Morgan at the head of Big Steel board, now fills shoes of Judge Gary.

Switzerland and Holland decide to maintain gold standard . . . Home again at Friedrichshafen, the Graf Zeppelin completed a successful flight from Pernambuco, Brazil . . . Flying time 84½ hours . . . Thus ends first round trip on regular schedule . . . Germany meets April 1 interest payments . . . Some wonder whether feat can be duplicated in June . . . Favorable Teuton trade balance a bright spot . . . British biplane is built to fly 200 miles per hour at 3-mile altitude . . . Pilots wear heated clothing . . . Despite increased wages for factory workers and leaders, famous Nizhni-Novgorod Soviet auto factory is down, disorganized . . . Unified control, discipline and less interference with technicians are needed . . . MacDonald and Tardieu confer in London . . . Reparations and debts.

Ford eights are here at last . . . Bottom list price $460 . . . new fours to be $50 less . . . General Motors retaliates with Chevrolet and Pontiac price cuts . . . rounds out consolidation program with closer knit sales force . . . Hupmobile follows price reduction trend . . . Auburn takes opposite tack announcing $100 price increases effective April 15 . . . Spring sales drives are now in full swing with many makers sponsoring special displays . . . Automobile, airplane, truck and industrial motors sold in first quarter by Lycoming totaled 3807 . . . 88 per cent over last year.

> 412,416 men have been given jobs in United Action Drive to put a million men to work . . . this is an increase of 70,857 over last week and affects 2,121 cities and towns.

Westinghouse receives order for $2,000,000 worth of electrical refrigerators . . . 150 freight cars will be needed to haul shipment. Forty Muskegon factories agree on three-day schedule until normal capacity is reached . . . Studies of 379 industrial concerns show drop in earnings from 1920 to 1921 to be 91 per cent . . . 1930 to 1931 was 78 per cent . . . Inventories, receivables, and liabilities are down . . . cash on hand is up . . . Between 500 and 600 men added to the Pullman Corporation payroll . . . about 60 air-conditioned cars are on order . . . Owens-Illinois Glass Company reemploys 200 workers . . . New York Central reports 380 new industrial plants locating on its lines in 1931 . . . American Sheet & Tinplate mills resumed operation April 4 . . . 2600 men return to work . . . Briggs Manufacturing payroll up 59 per cent.

· REGIONAL · REPORTS ·

NEW YORK—One large power shear and two or three small machine tools among known sales of machine tools by dealers during past week. Navy inquiry seeks bids on 14 tools including four shapers, four drill presses, four lathes and two power hack saws for four cruisers. Industrial inquiries are few, though some dealers report them on increase. Sales expected from a few. Brighter automotive prospects add slight encouragement.

NEW ENGLAND—Market is jumble of actual and potential prospects. Manufacturers with 50 per cent of machine tools and production equipment more than 10 years old, are numerous. Nothing but bright spots radiate from such a picture. However, such prospects have not been fruitful of good volume of orders. Situation still wrapped in dullness. March totals low although in some cases an improvement over February, with Ford and Navy leading buyers. New orders for grinding equipment placed by Ford while Navy closed bids on new list April 5. Chrysler has given some indication of more pronounced buying program.

CLEVELAND—A few dealers report increase in sales for March. More inquiries, mostly from automobile manufacturers, hearten machine tool industry. Machine shop, hardware and woolen manufacturers are recent buyers. Additional Ford releases announced. Active market for machine tools in prospect when conditions start to improve. Montague Machine Co. bought one open-side planer.

CINCINNATI—Machine-tool manufacturers and selling agents are having little response to strenuous merchandising efforts. Scattered orders coming from various classes of users. Aggregate forms merely a small volume. Inquiries "as was." Number fair for present conditions. Replies do not bring orders except in rare cases. Hope of improvement has not vanished, but there is little optimism as to near future.

CHICAGO—March closed leaving trade in doldrums. Dealers and manufacturers never quite so blue. Two dealers, however, found March best month of year, due to lucky breaks. Inquiries still active. Plenty of business in offing. Dealers and makers kept busy furnishing all kinds of service which shops demand more and more.

WHILE the drive which the auto industry has initiated to stimulate trade in cars has thus far had no immediate effect on tool and equipment purchases, it may be expected to result in worthwhile business when production starts filling orders. Otherwise a few Navy inquiries and purchases here and there helped keep the tool industry occupied. From all sections come reports of machinery and equipment badly in need of repair and replacement.

NEW YORK had a light week, with a few small sales and a Navy inquiry the only disturbance. New England hopes for business from plants with old equipment but still is deep in gloom. March was slightly better than January or February in Cleveland, and inquiries there increased. Cincinnati tool makers and agents are working hard for sales but with little success. Only two Chicago dealers had a lucky break in March. Others are bluer than ever. Buyers demand more and more in the way of service. A distinct improvement of morale in Detroit followed the latest automotive developments in models and prices. Much the same condition obtains in Milwaukee.

DETROIT—Distinct improvement of morale followed announcements of new models and new low priced cars. Machinery and machine tool dealers have not yet had opportunity to observe tangible improvement, but report better feeling throughout territory. Some increase in number of inquiries recorded and a few small sales made within last ten days. Proprietors of contract jobbing shops anticipate rapid increase of orders from auto manufacturers and may soon be in market for tools and miscellaneous equipment. Manufacturers of cars and accessories not likely to come into market immediately for machinery and equipment on large scale. But if production meets expectations, or comes near estimates, considerable equipment will be required.

MILWAUKEE—New optimism among machine tool and machinery manufacturers results from Ford announcement and first showing. Effect on new business still speculative, but move has softened disappointment of improvement anticipated for first quarter. With one or two exceptions first quarter was below last quarter, 1931, though most manufacturers report inquiries nearer closing. Chrysler second best prospect to Ford in automotive field. Electric motor manufacturers place a few preliminary orders with more inquiries outstanding. Other electrical manufacturers and telephone equipment producers also placed some business. Special equipment being made for one tractor manufacturer. Both manufacturers and selling agents doing some business with general machinists and miscellaneous users, not enough to build up satisfactory volume.

MATERIAL TRENDS AND PRICES

Higher asking prices for second quarter steel requirements are announced at $1.60 per 100 lb., base, Pittsburgh. Steel is still being used, however, on orders placed at $1.50. Mill operations, in the meantime, have dwindled to 22 per cent of capacity, the lowest since the Jan. 9, 1932 level of 22 per cent. Possibilities of better demand are seen in the direction of the railroads and the automotive industry; other consumers show little interest. With the exception of continued fluctuation in tin, non-ferrous metals, including scrap, were subjected to no price changes during the week.

(All prices as of April 1, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$10@$11	$10@$11	$12.00
Buffalo, No. 2, Fdry., per gross ton	14@ 15	14@ 15	17.50
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.00	12.25
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.50
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb	1.50@1.60	1.50	1.65

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Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.

Chicago....4.62½	Cleveland....4.50	New York....4.75	
Cincinnati....4.35	Detroit....4.00		

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Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.55	3.20	3.00	3.00
Hot-rolled, No. 24*	2.20	3.55	3.25	3.50
Galvanized, No. 24	2.85	4.10	3.75	4.00

*Annealed

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Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

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Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	5.95	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.55	3.50
Rivets	4.00	3.30	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

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Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except stove), nuts and lag screws, mill lots 75%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn.	6.00
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	3.00
Tin, Straits, pigs, spot, N. Y.	21.87½
Zinc, slabs, E. St. Louis	2.77½
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.25
Brass sheets, high	12.50
Brass tubing, high	15.75
Copper, drawn round	12.87½
Copper sheets	15.37½
Copper tubing	14.87½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	29.00
Babbitt, com'l, intermediate grade	34.75
Babbitt, genuine, highest grade	43.50
Solder, bar	17.00
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.00	2.00	1.75
Light brass	1.50	1.25	1.50
No. 1 rod-brass turnings	2.25	2.25	1.75
Heavy copper	4.00	3.25	2.50
Light copper	3.25	2.75	2.50

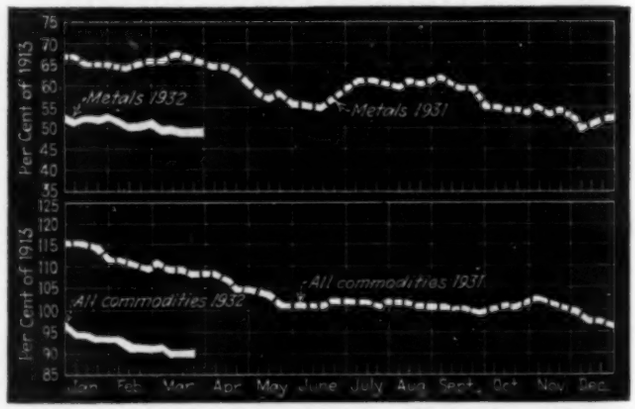
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40–5%	40–5%	40–5%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60–10%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.

Crating — Southern pine:
1x4-in., sq. ed. ..... $27.00 1x6-in. $24.00

Skids — Spruce:
2x4-in. .$35.00 3x4-in. .$35.00 4x6-in. .$37.00 6x6-in. .$50.00


Per Cent of 1913
Metals 1932
Metals 1931
All commodities 1932
All commodities 1931
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

Auto Makers Stage Huge Country-Wide Drive for Sales

IN A determined drive to tempt the dollars from the pockets of the citizenry before the tax collectors reach them, the automobile industry presents a spring array of new models and new prices. Ford, Chevrolet, and Plymouth, the big three of the low-priced field, have each made an outstanding merchandizing move.

The long heralded Ford V-8 is displayed with prices ranging from $460 to $650 f.o.b. Detroit. Using the same body line, the corresponding four-cylinder models are listed at $50 less. Fourteen styles are announced for each motor. All the newer sales features except free-wheeling are included.

General Motors replies with price cuts in two lines, Chevrolet and Pontiac. Chevrolet's list starts at $445 for the roadster and goes to $625 for the landau phaeton thus sandwiching between the two Fords. Pontiacs now range from $625 to $795. Some believe this car is being groomed to compete directly with the Ford V-8.

The new Plymouth with a 3-inch longer wheelbase, now treads upon the heels of its companion car De Soto. The Plymouth is priced from $495 to $745, with two models added to the line. Falling in with the popular trend, Hupmobile has cut prices on its 6-cylinder line as much as $280 on some models. Auburn, in contrast, has announced a price rise of $100 on all models as of April 15.

The drive for new business does not end with price cuts and new models. Skilled showmanship has been called upon to make car displays alluring to the public eye. Ford is using sound films to show the V-8 operation—also Henry and Edsel Ford stamping No. 1 on the first engine.

General Motors is staging a repetition of its private shows of January. Hudson, Studebaker-Pierce Arrow, and others have followed suit.

Early reports from all showings indicate an enthusiastic public reception. The Ford headquarters in New York was forced to keep open until midnight with visitors arriving at the rate of 4,500 an hour. General Motors special showing at the Hotel Astor resulted in numerous sales and a prospect list of over 1,000.

The G. M. sales program is to be given unified effort with consolidations in its sales forces, following the manufacturing solidification of last week. Sales of Buick, Oldsmobile and Pontiac are now combined and headed by R. H. Grant, G. M. Vice President. Dealers will not be disturbed. New sales zoning is part of the revised marketing set-up.

The entire drive of the autobuilders has received Presidential blessing. President Hoover in a formal statement pointed out that, "Every person contemplating buying a new car this year can make a real contribution to employment by putting in his order now."

Aircraft Show On at Detroit

Detroit, April 3.—A definite increase in the trend toward all-metal plane construction, greater specialization in design, and more attention to the problems of production are outstanding characteristics of the airplanes shown at the National Aircraft Show which opened at the City Airport here yesterday and continues to April 10. The leisurely production pace of the past year has made possible a number of decided changes and refinements of design that improve both flying and production characteristics of the machines. Thus far, visitors have crowded the Show, one heartening indication in a fairly quiet industry.

Few general utility planes are on exhibit. Such details as baggage compartments, at first neglected in the rush to get planes into production, have now been added. The new Privateer 3-place amphibian has a hull with aluminum alloy bottom and fabric side and top covering over a welded steel tube structure. Other manufacturers are also using welding more liberally in the effort to avoid the difficulties of riveting in close quarters. Larger cockpit openings, redesigned windshields, relocated baggage compartments and redesigned cowling are incorporated in the new Great Lakes Sport Trainer as a result of that company's study on difficulties of production and maintenance. This allows greater accessibility of engine and instruments for installation and servicing. Hammond & Haddon, who have bought manufacturing rights for the Parker & Ryan Speedster, are showing one model.

A new contribution to the "sportsman" type of plane has been made by W. B. Kinner in the form of a strut-braced low-wing monoplane with a unique one-man folding wing arrangement and side-by-side seating for the two passengers. Distribution will be direct from the factory on a time-payment plan requiring no insurance. Few other manufacturers have done anything with the folding wing idea because of prejudice, but several other companies are now making side-by-side seating. The "one-man" idea, abstracted from automobile construction, has also been adapted for a convertible winter top in the Waco Model A.

Three fast new Army fighters are on view, the Boeing PE-12 with all-metal monocoque fuselaged biplane, a 2-seat Berliner-Joyce pursuit plane, and a Curtiss-Hawk P-6E. The new Kellett Autogiro is also on exhibition, with several refinements over the earlier design. One that is particularly interesting is a rubber-mounting for the engine. Two other rotating-wing craft are shown, one an improved Pitcairn, the other a machine essentially different in principle from the Autogiro, the Wilford Gyroplane, of which only the rotor element is on view. Most important element of rotating-wing planes, the rotor hub, is an exclusively machine-shop product.

New Chrysler Plant At Los Angeles

Chrysler is building a West coast factory at East Los Angeles, Calif., to be finished by July 1 at a cost of $2,000,000. The factory will occupy a 27-acre site. The main manufacturing building, 1,100 ft. long and 305 ft. wide, will be of steel, brick and concrete, one story high. Its capacity, when complete, will be 200 bodies and chassis daily.

The first two departments to be equipped, according to CHARLES H. FENNELL, Chrysler works engineer, will supply repair parts to dealers in the West coast area and will manufacture and assemble Dodge trucks. Truck manufacturing activity has been located for several years at Stockton, Calif. According to the announcement, the factory will contain several new ideas in finishing ovens, cold processes of rust-proofing, co-ordinated conveyors, etc. Heat-treating ovens will be raised from the floor.

Doehler Abandons Diversification

Doehler Die Casting Co. has decided to abandon its policy of diversification which carried it into the aluminum utensil retailing field and other lines affiliated with the die-casting business. Household Institute, Inc., a subsidiary, will discontinue the sale of such utensils on the installment plan. The company is negotiating a merger for its subsidiary, Doehler Furniture Co., whose unit, Doehler Vending Machines, Inc., will be discontinued and joined with the parent company. The die-casting division of Bohn Aluminum & Brass Corp. and Newton Die Casting Corp., the latter owned formerly by National Lead Co., have been absorbed.

Materials, tools and equipment are also shown in profustion. Oxy-acetylene welded airplane parts are shown by Air Reduction Sales. Ex-Cell-O Aircraft & Tool has an assortment of broaches and broached parts and a group of tungsten carbide tipped cutting and form tools. Parker Appliance is showing a number of small fabricating tools. Wyman-Gordon is showing drop forgings and three ball and roller bearing manufacturers have examples of their production on display.

European Customs Policies Hold Threats and Opportunities for U. S. Industries

English Offer German Manufacturers Inducements to Come to British Isles. Poland Practically Excludes German Machinery

BERLIN CORRESPONDENT

THE ECONOMIC situation of a large number of European industrial and agricultural countries, growing worse from day to day, has precipitated a series of events, some of which will affect American manufacturers and their exports and should be taken into consideration with respect to expansion, investment of capital, and advertising in the European markets.

England's safeguarding, through the imposition of customs tariffs, will cause small and weak firms to suffer for some time. Individually owned companies which comprise a large percentage of the machine industry everywhere nowadays, will hardly be prejudiced for ever. Their products are assured further sales because of their patent rights, and, on the other hand, England's safeguarding measures will cause a flood of offers for patent rights to cover all machine-producing countries, which should satisfy the prejudiced exporters by allowing them to increase their commissions, should their products really be indispensable. This will cause the English consumers, critical enough as they have become through the drop in exchange, to apply to their government for special importation regulations. In this respect opinions are rather optimistic in Germany.

British Enticements

A further reason which permits German manufacturers to view the English import regulations with calmness is caused by the flood of offers and enticements by which English cities and industrial centers are endeavoring to draw German manufacturers to England. One town motivates its offer with low rates of taxation, particularly alluring to the German manufacturer whose prices are increased to such an extent by a large number of enormously high taxes; another town mentions cheap power supply (electricity or gas), or points to its specially advantageous transport facilities, etc. Another means of enticement is supposed to be the comparatively low wage (depreciation of the sterling currency), and finally, participation of British capital is held out to the expectant joyfulness of German manufacturers.

However, Great Britain's private industry also makes use of the present constellation in the British customs and currency heavens by endeavoring to win their German competitors as allies. This is clearly shown by the efforts of a universally known English file and tool works toward one of its most important German competitors. The director of that English firm personally requested the works, situated in South Germany, to loan him a large number of special machines, a technical staff, and even proposed participation under most liberal conditions. Though national-minded German circles, the government as well as trusts, still urgently discourage emigration of German factories to foreign countries, representing the British enticements to be unscrupulous plans of speculators, it is advisable for machine producers in other countries, particularly the United States, to keep a watchful eye on further developments. Otherwise it may easily happen that the American machine industry will suddenly find the English market, including that of its dominions, blocked as a result of this English-German combine.

Poland Throttles German Imports

Another country which, in its customs policy, has made itself noticeable lately, is Poland, the government of which has practically throttled German imports. This has resulted from the customs conflict existing for some time with Germany (through Poland's nonratification of the German-Polish commercial treaty in 1930), and because of the crisis in the Polish metal-working industry. The German machine industry has been affected to a particularly high degree, and as the former of the two customs blockade reasons is of greater concern in the effective exclusion of German goods than is the latter (economic crisis), new possibilities, or even probabilities, are open for American industrial and export circles. The importance of the new Polish measures against Germany, formerly Poland's chief supplier, lies chiefly in the import prohibition for all products of the crane and elevator industry, for centrifugal pumps, metal working machines, electrical machines, a host of special machines not specified in the tariff, and finally for all armatures, fittings, and tools. This, together, amounts to 39 per cent of the Polish machine imports, so that, adding the import prohibits existing since 1925, approximately 54 per cent of the Polish market is directly closed to German machine exports. Now, while other foreign countries, which have commercial treaties with Poland, are put into a position to further sales to Poland, the German machine manufacturer, who depends almost entirely on exports, and up to now was Poland's main supplier, must look on while the market is gradually being seized by his foreign competitors.

It is, of course, wrong to assume that now all orders which previously went to Germany, are being distributed among other foreign firms. Poland is really involved in a serious economic crisis, its buying power has diminished, and apart from this the reasons that led to the customs blockade may actually be sought in the protection of Poland's home industry. These facts are best demonstrated by figures:

In January, 1931, the production of pig iron amounted to 32,292 tons; in November, 1931, to 21,900 tons; in December, 1931, to 18,200 tons; while in January, 1932, only about ⅓ of the quantity for the same period in 1931, viz. 11,700 tons.

The number of loaded railway trucks despatched dropped to 6,093 in the first ten days of January, 1932, compared to 9,923 in the first ten days of December, 1931. Prices of agricultural products have dropped by about 50 per cent during late years. These few statistic fragments are sufficient to show that Poland is also involved in a crisis, heavy enough on the one side to decrease the total machine imports compared to former years, but which on the other hand opens up new perspectives to the American manufacturer, considering the import prohibits for German products.

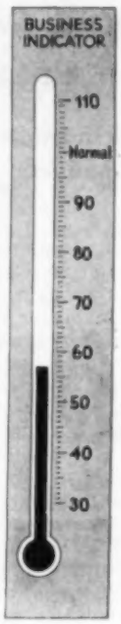
Germany Establishes Used-Tool Export Duty

A German government decree, effective Mar. 27, established an export duty of 800 Reichmarks per 100 kilos on certain used machinery and used machine parts, including textile machinery, wood and metal-working machinery, and other machinery not specified in the tariff, according to a cablegram to the Department of Commerce from Commercial Attaché H. LAWRENCE GROVES, in Berlin. It is stated that the measure is intended to restrict industrial migration abroad and to avoid dislocation of machinery markets.

THE BUSINESS WEEK

April 6, 1932

Exaggerated anxiety about balancing the budget upset the mental balance of business and gave a set-back to spring optimism during the past week; but All Fools day was celebrated by a return of Congressional sanity, and somewhat embarrassing speed in plastering on the taxes everybody is asking everybody else to bear. The fiscal stage is now set for further deflation, unless the rapid expansion of Reconstruction Corporation activities and Federal Reserve open market operations can offset its influence. Bank credit construction continues at about the same drastic rate as in recent months and is reflected in declining business volume and weak commodity prices. The steady unseasonal return of currency from circulation, reassuring from the standpoint of bank liquidity, is perhaps becoming a symptom of contracting consumer purchasing power and trade recession. A late spring upturn in merchandise freight movement is encouraging, but steel activity, power production and most other indicators have relapsed to low levels. All eyes are now turned to the intrepid drive of the automobile industry against the deepening depression. These dauntless adventurers, almost the last apostles of the principles of prosperity and progress in whom a shred of old-time American enterprise and initiative survives, are courageously casting their last die against the grubbing gospel of penury and despair that has apparently gripped the brains of American business leadership, and have set up an inspiring standard to which the fearless, faithful and forward-looking can repair.



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Politics Overshadow Industry, British Tariff Troubles France

PARIS CORRESPONDENT

IT IS NO exaggeration to state that French opinion today is more centered on political, economic and financial aspects of the country's needs than on the purely industrial side. Prices of raw, semi-raw and manufactured consumer goods are manifestly more stable than they have been for some time, standing virtually at 421, which is considerably under the coefficient representing the par value of the franc. Railway receipts plainly indicate industrial slowing down in north and east France where the heavy industries mostly dominate. These receipts have fallen 25 per cent from those of February, 1931.

The machinery and engineering index for 1931, referring to production output of three principal European countries, as compiled by the Economic Section of the League of Nations, shows that, in spite of the depression cloud which had only just begun to hover over her, France was more than holding her own on the basis of 100 in 1928.

	France	Germany	Great Britain
January, 1931	104.3	54.8	93.6
April, 1931	103.6	66.4	90
July, 1931	102.2	68.4	87.3
September, 1931	95.7	58	79.6
January, 1932	89.9	49.6	...

The figures might seem surprising and disproportionate if one did not recall that world conditions have changed the relations of foreign trade. Some allowance must also be made for possible variation in the method of compiling such figures in the different countries. It may be taken for granted, however, that France, though relatively low in the scale as compared with the capacity output of Germany and Great Britain, was operating on a post-war basis notably greater than that of a generation ago.

Imports are now embargoed for three months on wireless apparatus coming from Germany, also metal toys and games. Electrical goods from Great Britain and Sweden are shut out as well until the second trimestre and only various contingent quantities of certain household and metal goods may be imported from Germany.

What touches the United States most closely is the proposed limiting of the quantities of machine tools which may be imported (*AM*—Vol. 76, p. 416e). This serious question is due to regulating at an early date, and when it comes it will be because France has recognized the distinction, accepted by so many other countries, between production and consumer goods. With this conception in view, the question should solve itself speedily.

"Buy French" Campaign Weak

In spite of the nation-wide campaign to "buy French," orders abroad seem to be proportionately as widely distributed as formerly. The bulk and values have dropped, but foreign trading has not been ruled out. A government arsenal has recently bought heavy forgings from Germany, and a navy yard has placed orders for machine tools in England. Germany and England are selling road-making and hydraulic machinery at prices better than obtained for French models—where they exist, which is not always the case.

With a government example such as this, to say nothing of "metal manufactures of all kinds," (including small tools and machinery for 74,000,000 francs on reparations account in 1931) to the volume of 30,000 tons and the value of 190,000,000 francs, purchased from Germany, the buying public may be expected to care little where its purchases come from.

Regardless of what is called here "the Hoover moratorium" certain classes of payments in kind from Germany greatly increased in 1931—refrigerating machinery from 1,612,000 francs to 5,552,000 francs and steel cable from 925,000 francs to 2,100,000 francs. Steam turbines quintupled in value, hydraulic machinery doubled as did electric heating appliances and various items imported under the generic name of "tools." Germany's grip is apparently strengthening rather than weakening.

British Tariff Hurts France

The fall of the British Labor Cabinet temporarily enchanted France, above all the Tardieu government and its majority of the right. Since the British tariff has begun its inflation, however, chilled expectations and enthusiasm have resulted. French automobiles and electrical apparatus have hardly been able to free the British tariff barrier, while a 25 per cent depreciated shilling has thrown all manner of metal manufactures from Great Britain onto the French market. Meantime Monsieur Tardieu is looking for new recruits as business allies by attempting to weld the Danubian countries into some sort of a trading unit which will be virtually a trade sphere for the exchange of French manufactures, metals and textiles for wheat and bacon-sides, with the United States and Canada, bearing the brunt of the burden.

Short Time Increases

Short time in France has greatly increased during the year. An official census of 9,000 establishments shows but 48.40 per cent working a 48-hr. week as against 82.9 per cent a year ago. Those working 40 to 48 hours, 19.8 per cent, compared with 11.5 per cent. From 32 to 40 hours, 13.4 per cent compared with 1.8 per cent. A 32-hr. week, 5.8 per cent against .2 per cent. Under 32 hours 3.9 per cent compared with .09 per cent.

The metal transforming trades for 1931 averaged but 53.13 per cent of full time, the super-luxury jewelry trades showing the highest figures, 93.02 per cent and the clothing trades the lowest, 51.61 per cent. Many other trades fell below 50 per cent.

Alien workers coming to France have been reduced notably in numbers in the past twelve months. The Ministry of Labor states moreover that at the end of 1931 there were 369,000 fewer workers employed than a year before.

Arrangements Completed for Survey of Die Casting Industry

More Effective Planning and Individual Operation Goals of A. D. C. I. and Commerce Department

ARRANGEMENTS are complete for a survey of the die-casting industry of the country by the United States Commerce Department. This is at the request of American Die Casting Institute as an aid to more effective economic planning and individual operation in this field, according to a recent announcement by FREDERICK M. FEIKER, director, Bureau of Foreign & Domestic Commerce. The American Die Casting Institute, sponsor of the survey, will cooperate actively in the work and supply funds to cover the special expenditures involved in the project.

The survey is in line with similar studies carried out by the Commerce Department in other industries. Its aim will be the elimination of distribution wastes in the interest of both producer and consumer. Leaders in the marking devices industry reported savings of $1,000,000 as a result of the survey made in that field alone. Similar benefits are reported from the confectionery, jewelry, grocery and other trades which have initiated like surveys.

The die-casting study will apply the lens of scientific merchandising research to the operations of concerns engaged in commercial production of die-castings which go into the manufacture of automobiles, radios, household appliances, business equipment, and numerous other articles in everyday use.

As outlined, the survey will consist of two phases. One part will comprise a general study of the industry to be conducted by the questionnaire method. The second phase is to be a special study of certain specific problems as found in the practice of six or eight specially selected plants. The aim of the study as a whole is to assemble data for the entire die-casting trade for the years 1928 to 1931 relating to total sales, cost of sales, expenses, sales of different types of castings, types of customers supplied, quantities of raw materials used and types of die-casting machines operated. Study will also be made of the types of personnel employed, salaries paid and methods of remuneration of the sales force.

The case studies of a small group of representative concerns will seek to determine points which are not readily obtainable by mail, but which are seen as necessary for solution of pressing problems of the industry. This phase of the survey will include practices respecting dies and special tools, and the procedure and factors involved in making of estimates.

The information obtained will be analyzed by the Department of Commerce and the results made public for the general benefit of the trade. Many of the findings will be presented not only as averages for the entire industry but also for groups of concerns of various sizes, so that any die-casting manufacturer may compare his individual operations with standards drawn from records of concerns of comparable size.

The institute's membership comprises concerns representing 80 per cent of the total output of the die-casting industry, estimated normally in excess of $25,000,000 yearly. The committee of the institute which will cooperate with the department in the survey includes W. G. NEWTON, president of the institute, CHARLES R. MURRAY, and H. R. RHINEHART, secretary.

N.E.M.A. Meeting

The Spring meeting of the National Electrical Manufacturers Association will be held at The Homestead, Hot Springs, Va., May 16-20. A program committee was appointed at the Feb. 26 meeting of the board of governors.

Safety Council Extends Service

National Safety Council is extending its service to industry by offering its help to any company, large or small, regardless of whether it holds membership in the Council or not. Safety work of several thousand industrial members in all branches of industries has recently been analyzed and the most effective techniques discovered will be made available without cost to any plant desiring a specific course of safety procedure. It is only necessary that a company desiring this service provide a few essential facts from which the Council engineers can draw up a practical working plan commensurate with the needs of the company and applied to the specific operating problems.

Service to members is also to be extended by way of a new "complete industrial service" plan. This plan is designed to reach not only management, key safety men and foremen, but also every employee. It recognizes the fact that safety is everybody's business.

Inter-department or inter-group safety contests have played an important part among companies conducting the most successful safety programs, according to the Council. Through this new service, the Council provides an industrial safety trophy, an attractive heavy bronze plaque 7½x11½ in., to be awarded to the department or group winning the year-round safety contest within the company. The individual workman is reached through the magazine "The Safe Worker" which is sent out monthly to every employee in the company. Payroll messages are also provided every worker as an added reminder of safety.

Soviet Completes Ball-Bearing Factory

The first section of the new Soviet ball-bearing factory, designed ultimately to be the largest in the world, began operating Mar. 29. Built during the last year under the supervision of American specialists, this first section is designed for an ultimate annual capacity of 24,000,000 bearings. This year's production is expected to reach 3,000,000. The factory is equipped with the latest foreign machinery and is hailed at Moscow as marking the beginning of Soviet independence of ball-bearing imports which have cost Russia millions of dollars a year.

Bendix to Give Employees Bonus

Bendix Aviation Corp. directors have recommended to stockholders that provision be made for giving employees a bonus not exceeding 10 per cent of any year's net earnings over a 7 per cent return on the capital employed. No bonuses will be paid at the current rate of earnings. Salary and wage reductions effective Mar. 1 this year are expected to produce annual savings of approximately $1,000,000, according to the report signed by VINCENT BENDIX, president.

A.M.A. Convention In New York May 3

The annual general management conference of the American Management Association, usually referred to as the Annual Convention, will be held in the Hotel Pennsylvania, New York, N. Y., May 3, 1932. The program follows: "Flexible Policies for Changing Conditions," by JAMES O. MCKINSEY, partner, James O. McKinsey & Co.; "Merchandising and Marketing for Changing Technological and Business Conditions," by E. VICTOR DONALDSON, president, Robert Gair Co.; "Adapting Planning to Rapid Changes," by PARKER MARGESON, general manager, Phoenix Hosiery Co.; "Maintaining a Flexible Organization for Changing Conditions," by O. D. REICH, vice-president, Dexter Folder Co.; "National Economic Planning for Changing Conditions," by MORRIS E. LEEDS, president, Leeds & Northrup Co.

Financial Conference

The annual financial conference of the A.M.A. will be held at the same place, May 4, 1932. Following is the program: "To What Extent Will the Actual Scrapping of Excess Plant Capacity Enter Into Our Final Industrial Readjustment?" by C. R. STEVENSON, partner, Stevenson, Jordan & Harrison; "What the Credit Man Can Do to Improve the Finances of Business Concerns or to Assist in Developing Sound Financial Policies," DR. STEPHEN I. MILLER, director of economics, R. G. Dun & Co.; "Corporate Financial Policies from Boom to Depression," by COLONEL MALCOLM C. RORTY, vice-president, American Founders Corp.; "Reducing the Cost of Distribution," by ALVIN DODD, vice-president, Kroger Grocery & Baking Co.; "Inflation-Deflation in Business," by DR. H. PARKER WILLIS, professor of banking, Columbia University; "Industrial & Financial Mergers in Boom & Depression," by ARTHUR STONE DEWING, professor of finance, Harvard University.

Steel Founders to Hold Spring Meeting May 18

The Spring meeting of the Steel Founders' Society of America, Inc., will be held May 18, at the Roosevelt Hotel, New York, N. Y., preceding by one day the meeting of the American Iron & Steel Institute.

General sessions of the Society, which are open to all principal executives of steel foundries in the United States and Canada, will be presided over by G. R. CASEY, vice-president of Treadwell Engineering Co. of Easton, Pa., and vice-president of the Society's Eastern division. Among the features of the program, announced by ARTHUR SIMONSON, vice-president of Falk Corp. and president of the Society, will be a discussion of "Deflationary Buying and Destructive Selling," and its effect on general business.

CLARENCE B. BARTLETT, an industrial analyst of Milwaukee, Wis., is to speak on the subject "The Cost of Dust in the Steel Foundry." Mr. Bartlett for the past year has been managing engineer of a committee of the Wisconsin Manufacturers Association on dust, fumes, vapors and gases, under the chairmanship of HAROLD S. FALK, Falk Corp., Milwaukee. In view of much proposed legislation in various states, dealing with so-called occupational diseases, Mr. Bartlett's message will be of value to all steel foundrymen who are quite liable to be directly affected by present trends.

The board of directors of the Society will meet on the same day.

Special Committee Meetings

Special committee meetings are planned, embracing the Joint-Cost Committee, which is preparing a new series of operating data reports, designed to increase foundry efficiency and reduce costs; Joint-Technical Committee, completing a publication for use in engineering and technical schools on the design, manufacture and use of cast steel.

Alloy Founders Division

The regular meeting of the Heat-Corrosion-Resistant Alloy Founders' Division, composed of producers of high-alloy castings, will be held the following day, May 19. W. B. SULLIVAN, of Michiana Products Corp., Michigan City, Ind., and chairman of the division, will preside. A. W. DANIELS, vice-president, American Manganese Steel Co., Chicago, and chairman of the executive committee, will direct the program. Some of the important subjects to be discussed are: Adoption of standard analysis specifications for the various grades of alloys intended for specific purposes, each manufacturer being expected to contribute from his own experience all pertinent information which in turn could be published in the form of a handbook on alloys for distribution to all buyers and prospective users; adoption of a code of ethical trade practices, under which the alloy industry would be governed; adoption of uniform guarantee for protection of the customer, as well as the alloy industry; adoption, after a thorough investigation, of a uniform method for arriving at the cost of metal, with scrap inclusions, and of a common-sense cost-finding method for each grade of alloy; development of engineering standards as applied to various grades of alloys for heat and corrosion problems.

• BUSINESS ITEMS •

Packard Motor Car Co., represented by ALVAN MACAULEY, president, was formally awarded the Collier Trophy by President Hoover, Mar. 31. The trophy was awarded in recognition of the Packard diesel aircraft engine. This trophy, considered the highest award in American aeronautics, was presented last year to HAROLD F. PITCAIRN.

Approximately $300,000 worth of orders have been received within the past two or three weeks by White Motor Co., Cleveland. These orders include 32 trucks for A. Fink & Sons, Newark, N. J., and 23 for Kraft Phenix Cheese Co., Chicago. The company is also building seven ambulances for Bellevue and allied hospitals of New York, and is completing the building of 774 garbage trucks for the City of New York, orders for which were closed late last year. Seven heavy-duty garbage trucks ordered by the City of Montreal probably will be built in the Montreal plant. The remainder of the work will be done in Cleveland.

Holo-Krome Screw Corp., Hartford, Conn., has been licensed by Dardelet Threadlock Corp. to manufacture and sell certain Dardelet products.

Stibloy Products Co., Inc., Koppers Bldg., Pittsburgh, has taken over the assets of Liquid Metal Products, Inc., Chicago, producer and distributor of a metal compound in liquid form that serves as a primary coating to hold paint, enamel and lacquer. Officers of Stibloy Products Co., Inc., control of which has been acquired by Koppers Products Co., are J. N. FORKER, president; S. H. BELL, vice-president; JOHN D. SHANER, secretary; and S. T. BROWN, treasurer.

Long Mfg. Co., Detroit, has begun production on a new line of copper radiators for industrial, domestic and other heating service. A subsidiary of Borg-Warner Corp., Chicago, Long Mfg. Co. formerly concentrated manufacture on automobile radiators and clutches.

Graphol Products Co., Inc., maker of rust solvents and lubricants, has moved to new headquarters at 408 DeKalb Ave., Brooklyn, N. Y.

New York Central Lines will employ approximately 7,000 men in April to make repairs in equipment, according to a recent announcement. Three of the Central's passenger shops and seven locomotive shops are to be reopened immediately. Rock Island shops at Shawnee, Okla., have called back 150 men.

Meeker Foundry Corp., Norwalk, Conn., has recently been taken over by FRANK COOKE, who will act as president and general manager. Mr. Cooke was connected with Grey Iron Foundry, Eastern Malleable Iron Co., Bridgeport, Conn., for four years. He was previously connected with Chevrolet Motor Co., Saginaw, Mich., and with Santa Fe Foundry, Richmond, Calif.

Gears & Forgings, Inc., Cleveland, has been placed in receivership with S. C. DALBIE, treasurer of the company and F. L. LECKIE, attorney, named as receivers. Action was brought by Republic Steel Corp., Youngstown, Ohio. The company is said to be fully solvent but without cash to meet current liabilities. Assets are set at $4,790,000 or more. Gears & Forgings, Inc., was formed in 1928 as the result of a consolidation of Van Dorn & Dutton Co. and Ohio Forge Co., both of Cleveland; Fawcus Machine Co., Ford City, Pa., and William Ganschow Co., Chicago.

Northern Corrugating Co., Green Bay, Wis., is making additions to equipment for manufacture of new lines, including steel seating for auditoriums, folding armchairs, etc. Volume of business for 1931 is reported to be 20 per cent ahead of 1930, with 36,000 more working hours than in any other year.

• PERSONALS •

HENRY LEVITT has been elected a director of Bohn Aluminum & Brass Corp., Detroit, succeeding W. T. BOHN.

RALPH S. DAMON has succeeded WALTER BEECH as president of Curtiss-Wright Airplane Co., St. Louis and Wichita, Kan.

LANGDON H. ROPER succeeds WILLIAM H. WHITE as president and general manager of the Waterbury Clock Co., Waterbury, Conn. L. ALLEN OSBORN, JR., has been elected executive vice-president of the company and GEORGE A. CLOSE has resigned as acting treasurer and secretary.

MYRON C. TAYLOR has been elected chairman of the board of United States Steel Corp., succeeding J. P. MORGAN, who has retired. In authority Mr. Taylor replaces a triumvirate that has been in charge of the corporation's affairs since the death of the late Judge Gary. JAMES A. FARRELL, president, will retire this month to be succeeded by WILLIAM A. IRVIN, now a vice-president. Mr. Irvin will rank next to Mr. Taylor, and will be concerned mainly with operations. Mr. Taylor was previously chairman of the finance committee, which position he still fills.

A testimonial dinner is to be given in honor of Mr. Farrel by the American Iron & Steel Institute at the Waldorf-Astoria Hotel, New York, N. Y., April 21.

ARTHUR BENTLEY, president of Miehle Printing Press & Mfg. Co., Chicago, has been elected a director of American Steel Foundries, Chicago. THOMAS DREVER, formerly secretary and treasurer of American Steel Foundries, has been elected vice-president and treasurer. O. E. MOUNT has been made secretary and assistant treasurer, and E. C. RHYMER has been made assistant secretary.

C. F. STANLEY has been made vice-president of Fafnir Bearing Co., New Britain, Conn. He was formerly assistant secretary of that company.

H. E. V. PORTER has been re-elected president and appointed general manager of Dahlstrom Metallic Door Co., Jamestown, N. Y. As general manager, he succeeds the late JOHN A. WESTMAN, who was secretary and general manager. SAM LUNDQUIST has been elected secretary to succeed Mr. Westman. Other officers re-elected at the annual meeting are CARL OLOFSON, vice-president; ERIC E. CARLSON, treasurer and assistant secretary, and ELMER W. SELLSTROM, assistant general manager and general plant superintendent.

WARREN B. HAMILTON has been elected president of W. W. Babcock Mfg. Co., Bath, N. Y., producer of metal specialties, succeeding the late WILLIAM W. BABCOCK. Mr. Hamilton will also continue as treasurer.

F. W. MCINTYRE, vice-president and sales manager of Reed-Prentice Corp., Worcester, Mass., has been made general manager in addition. J. F. RICHEIMER, formerly of Boston, Mass., has been made assistant treasurer.

NORMAN CALL, vice-president and secretary of Richmond, Fredericksburg & Potomac Railroad Co., has been elected president.

ARTHUR ANDERSEN, of Arthur Andersen & Co., Chicago, accountants; THOMAS MCMILLAN, president of Canadian Fairbanks, Morse Co., Ltd.; C. H. POPPENHUSEN and F. C. DIERKS have been elected directors of Fairbanks, Morse & Co., Chicago. They replace W. S. HOVEY, W. E. MILLER, F. M. BOUGHEY and H. W. FENTON, who resigned last year. P. C. BROOKS, a vice-president, has been made executive vice-president.

B. S. STEPHENSON has been made vice-president of American Radiator & Sanitary Corp., New York City.

R. J. MANION, Canadian Minister of Railways & Canals, has announced the appointment of WILLIAM J. CHRISTIE, of Winnipeg, as a director of Canadian National Railways. Mr. Christie, who is head of W. J. Christie & Co., financial broker, and a director of many other companies, will succeed S. E. RICHARDS.

THOMAS K. FINLETTER has been elected a director of American Machine & Metals, Inc., 100 Sixth Ave., New York, N. Y.

F. A. TETZLAFF has been elected secretary-treasurer of Perfex Corp., Milwaukee, manufacturer of automobile, truck and tractor radiators, space heaters, etc. He succeeds JOHN W. TAMBERT, who has been placed in charge of the heating division.

NORMAN R. CLARK has been elected vice-president of the Westfield (Mass.) Mfg. Co., succeeding the late JOHN P. FOGARTY. Mr. Clark has been secretary of the company. This position will be filled by CHARLES J. FOGARTY, son of the late Mr. Fogarty.

EDWIN G. THOMPSON, vice-president, Thompson Products, Inc., Cleveland, Ohio, has been elected treasurer.

L. F. LOREE, president of Delaware & Hudson Co., has resigned as a director of Erie Railroad after serving 23 years in that capacity. Mr. Loree's resignation was prompted by the removal of executive offices of the road to Cleveland which would make it difficult for him to attend meetings.

Production and Operating

FLOYD O. TANNER, assistant manufacturing manager in charge of Flint, Saginaw and Bay City, Mich., operations of Chevrolet Motor Co., has been appointed general factory manager of the Oakland Motor Car Co., Pontiac, Mich. ARNOLD LENZ, formerly manager of Chevrolet Gray Iron Foundry, at Saginaw, succeeds Mr. Tanner. Mr.

WILLIAM M. BAILEY

New Chief engineer of Dubilier Condenser Corp., New York, N. Y.

Lenz and HUGH DEAN, in charge of Chevrolet's Detroit and Toledo plants, will be under the direction of CHARLES E. WETHERALD, general manufacturing manager. JAMES MILLER, foundry superintendent at Saginaw, will succeed Mr. Lenz as manager. H. P. MCGREGOR, Chevrolet plant manager at Flint, becomes general superintendent of Oakland Co. WILLIAM NOTMAN, general superintendent of the Motor Division of Chevrolet at Flint, succeeds Mr. McGregor. WILLIAM SCOTT, night superintendent of the Flint Motor plant, has been appointed general superintendent.

KARL GROSS has accepted a position with Northern Blower Co., Cleveland.

Sales

H. C. DARBY has been appointed district sales manager for Inland Steel Co., Chicago, at the Kansas City, Mo., office. Mr. Darby, a member of the sales force of that company since 1926, succeeds the late ORVILLE P. BLAKE, previous manager of this office, who died Feb., 1931. MARK HILL has been appointed salesman in the Kansas City office.

CHARLES V. FISH has been appointed by Reliance Electric & Engineering Co., Cleveland, O., manufacturers of alternating and direct-current motors, to represent them in Allentown and Northeastern Pennsylvania. Mr. Fish, who has had a long experience in electrical engineering, will be located at 515 North Lafayette St., Allentown.

WILLIAM S. WILBRAHAM, who has been in charge of the Estimating and Order department at Lukenweld, Inc., Coatesville, Pa., since its establishment in 1929, has been appointed assistant manager of sales, and will work directly with HENRY H. PECK, manager of sales. Mr. Wilbraham joined Lukens Steel in 1927, and was transferred to Lukenweld when it was formed.

Activities

ERNEST L. THEARLE, research engineer, General Electric Co., will speak on "A New Type of Dynamic Balanc-

ing Machine" before the Applied Mechanics Division, Metropolitan section, A.S.M.E., April 26, 1932, in the Engineering Societies Bldg., 29 W. 39th St., New York City.

BENJAMIN SCHWARTZ, director general of Institute of Scrap Iron & Steel, presided at a meeting of American Trade Association Executives, held at the Hotel Pennsylvania, New York City, Apr. 5. The relation of the trade association movement to the stabilization of business was discussed.

D. B. PORTER, of the College of Engineering, New York University, spoke on the "Value of Graphic Charts in Production" before the Management Division of the Metropolitan section, A.S.M.E., April 6, 1932, in the Engineering Societies Bldg., 29 W. 39th St., New York City.

F. O. HOAGLAND, chief consulting engineer and master mechanic, Pratt & Whitney Co., Hartford, Conn., spoke on the subject of "Jig Boring Machines and Practice" before the Minneapolis section of the A.S.M.E., March 25. The talk was given in the plant of the Gopher Machine & Tool Co.

ROBERT HOIERMAN, Alliance, O., secretary of the Ohio Foundries Association, will be one of the principal speakers at the foundries section of the All-Ohio Safety Congress to be held in Columbus, April 19 to 21. The Congress is sponsored by the Division of Safety and Hygiene of the Ohio Industrial Commission. He will discuss "The Safety Drive in Ohio Foundries." C. E. LITTELL, Canton, O., is chairman of the vocational Teachers' Safety Training Division, and will act as chairman of the sectional group.

ALBERT R. LATSON, 30 Wall St., New York, N. Y., has been made receiver in equity for Adriance Machine Works, Inc., 80 Richards St., Brooklyn, N. Y. Application for the receivership was made by Revere Copper & Brass Co., Inc., Baltimore, Md. Assets of Adriance Machine are said to be much in excess of its liabilities.

J. T. MCQUILLEN, 9207 Clifton Blvd., Cleveland, Ohio, has resigned from the sales force of Black & Decker Mfg. Co. after eight years of service.

F. W. CURTIS, research engineer, Kearney & Trecker Co., Milwaukee, Wis., will speak on, "Design of Machine Tools for High-Speed Use," at a meeting of the Chicago local sections, A.S.S.T. and A.S.M.E. April 14.

• OBITUARIES •

FRANK T. MCDONOUGH, until recently sales representative of the Niles Tool Works Co., Chicago, was killed in an automobile accident March 25 in Hanceville, Ala. Mr. McDonough has been identified with the machine tool trade in Chicago for the past 25 years.

CHARLES W. CHADWICK, 68, vice-president of the Syracuse Twist Drill Co., died recently at his home in Syracuse, N. Y., following a brief illness.

SAMUEL M. CURWEN, 72, president of J. G. Brill Co. of Pennsylvania and affiliated companies, manufacturer of street railway equipment, died Mar. 29 at his home in Haverford, Pa. He had been active in business until three days previous when he suffered a general breakdown. In addition to the presidency of J. G. Brill Co. of Pennsylvania, Mr. Curwen was chairman of the board of Brill Corp. of New York and a director of American Car & Foundry Motors Co. and American Railway Car Institute, both of New York. He was also a director of several banking and insurance companies.

WILLIAM THOMPSON GRAHAM, 89, of Greenwich, Conn., and New York City, founder and former president of American Can Co. and director of many large corporations, died of pneumonia, Mar. 29, in New York City. Mr. Graham was chairman of the board of Metal & Thermit Corp. and a director of Bankers Commercial Security Co., Inc.; Bankers Commercial Corp.; Chromium Corp.; Individual Drinking Cup Co.; and International Nickel Co. of Canada, Ltd.

WILLIAM C. HARRISON, 41, vice-president of Oxweld Acetylene Co. and eastern manager of Linde Air Products Co., died Mar. 30 in New York City.

Prof. FRANCIS M. HARTMANN, 61, dean of the School of Engineering of Cooper Union and professor of electrical engineering, died, Mar. 28, at his home in New York, from a blood clot on the brain.

LEWIS H. KITTREDGE, president of Peerless Motor Car Co., Cleveland, from 1906 to 1921, died in Cleveland, Mar. 28.

JOHN B. MCKAY, 61, superintendent of Stockton Iron Works, and former head of McKay Foundry Co., San Francisco, Calif., died in San Francisco, Mar. 22, following two operations for appendicitis.

JULIUS ROEDER, 73, head of Waterloo (Ia.) Metal & Mfg. Co., since its establishment in 1926, died Mar. 23 in a Waterloo hospital, where he had undergone an emergency operation for appendicitis.

CHARLES P. RUSSELL, 59, treasurer of John W. Russell & Sons, North Adams, Mass., died recently at his home at 101 Lakeside Street. He was treasurer also of the National Metal Trades Association.

ARTHUR JARVIS SLADE, 59, of New York, a mechanical engineer who served as chief of the engineering division of A.E.F. Motor Transport Corps during the World War, died Mar. 30 in Naples, Italy.

MORRIS SLEPKOW, expert on face-grinding equipment, died suddenly Feb. 23, in Philadelphia, Pa. For over 30 years Mr. Slepkow was connected with Diamond Machine Co., Providence, R. I. He left Diamond to enter the employ of Bridgeport (Conn.) Safety Emery Wheel Co. in 1931. He had latterly been engaged in the service and sale of face grinders and other grinding machines.

ELBERT A. VAUGHAN, formerly of the Vaughan Motor Works, Portland, Ore., died March 14 of heart trouble at his home in that city. He was the inventor of numerous machines finding their principal use in the logging industry.

CORNELIUS M. WALSH, 68, president and general manager of the Falls Hollow Staybolt Co., Cuyahoga Falls, O., died March 25 of heart disease at his home in that city.

HENRY J. WIEGAND, 59, for many years manager of operations of Cutler-Hammer Mfg. Co., Milwaukee, died recently after a long illness. Mr. Wiegand, who retired Apr. 1, 1927, because of ill health, had been associated with the company for 30 years.

• MEETINGS •

AMERICAN WELDING SOCIETY
Annual meeting, Engineering Societies Bldg., New York, Apr. 27-29. William T. Spraragen, secretary, 29 W. 39th St., New York City.

AMERICAN MANAGEMENT ASSOCIATION
Annual meeting, Hotel Pennsylvania, New York, May 2, 1932.
Annual meeting, Institute of Management, Hotel Pennsylvania, New York, May 5, 1932. W. J. Donald, Managing Director, 20 Vesey St., New York, N. Y.

FOUNDRY AND INDUSTRIAL EXPOSITION
Also 36th annual convention, American Foundrymen's Ass'n, Hotel Statler, Detroit, Mich., May 3-5. C. E. Hoyt, manager, American Foundrymen's Ass'n, Inc., 222 W. Adams St., Chicago.

AMERICAN GEAR MANUFACTURERS ASS'N
Sixteenth Annual Meeting, Hotel Statler, Cleveland, Ohio, May 12-13. Executive Committee meeting, same place, May 11. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL MACHINE TOOL BUILDER'S ASS'N
Third National Machine Tool Show, Cleveland (Ohio) Municipal Auditorium, Sept. 10-17. Boyd Fisher, general manager, 1415 Enquirer Bldg., 617 Vine St., Cincinnati, Ohio.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eiseman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ark., Fort Smith — Standard Oil Co. of Louisiana, H. Armstrong, Local Mgr., will build a bulk oil and service station including 36 x 48 ft. garage, 40 x 90 ft. warehouse, etc., at Midland and North Sts. Estimated cost $35,000. Work will be done by local labor.

Conn., Greenwich—Town will receive bids about May 1 for construction of a 2 story municipal garage on Mianus St. Estimtaed cost $40,000. C. W. Hubbard, 115 Greenwich Ave., Archt. Noted January 28.

Conn., New London—Connecticut Co., Norwich, will build a 1 story bus garage on Montauk Ave. here. Estimated cost $40,000. Work will be done by owner's forces under the supervision of company engineer.

Ind., Indianapolis—Board of School Commissioners, A. B. Good, Business Director, will receive bids until April 21 for remodeling south room of new shop building at Arsenal technical schools.

Ill., Chicago—Firestone Tire & Rubber Co., c/o H. A. Platt, 1920 South Michigan Ave., awarded general contract for construction of a 1 story, 100 x 175 ft. service station at 4400 West Madison St. Estimated cost $50,000. Noted March 31.

Ind., West Lafayette—Purdue University, plans construction of a 3 story, 60 x 230 ft. engineering building. Estimated cost $200,000. W. Scholer, Archt.

Me., Portland—Cushman Baking Co., 107 Elm St., awarded contract for construction of a 2 story garage on Lancaster St. Estimated cost $40,000. Noted March 31.

Md., Baltimore—Treasury Department, Office of J. A. Wetmore, Supervising Architect, Washington, D. C., will receive bids until April 15 for construction of main building, garage, power house and laundry building at U. S. Marine Hospital here.

Mass., Ayer—Constructing Quartermaster, plans construction of a service garage at Camp Devens. Estimated cost $30,000.

Mass., Cambridge (Boston P. O.)—George A. Fuller Co., 11 Beacon St., Boston, Gen. Contrs., awarded sub-contracts for construction of a 5 story technical high school at Broadway and Irving St. for School Commission. Estimated total cost $1,500,000. Noted February 18.

Mass., Cambridge (Boston P. O.) — Shell Eastern Petroleum Products Inc., 141 Milk St., Boston, awarded general contract for a 1 story service station at Memorial Drive and Magazine St. here. Estimated cost $25,000. Noted March 3.

Mass., Holyoke—C. W. Rackliffe, c/o G. P. B. Alderman & Co., 316 High St., Boston, Archts., completed plans for a 1 story sales and service station at 156 Elm St. Estimated cost $40,000.

Mass., Somerville—Department of Public Buildings, plans construction of a 1 story municipal garage. Estimated cost $50,000. Architect not selected.

Mass., Springfield—Henry E. Puggioli, 27 Border St., receiving bids for alterations to sales and service station, 3 story, 65 x 105 ft. on Liberty St. Estimated cost $40,000. J. W. Foster, 72 Narragansett St., Archt.

Mass., Weymouth—Crawford Machine Co., Central Ave., plans to rebuild 2 story factory destroyed by fire. Estimated cost $50,000. Work will be done by separate contracts. Noted March 3.

Mich., Detroit—U. S. Engineer Office, Old Custom House, will receive bids until April 15 for construction of a warehouse at Atwater St. and Detroit River. Estimated cost $40,000. Smith, Hinchman & Grylls, 800 Marquette Bldg., Archts.

Mich., Wayne—Constructing Quartermaster, Selfridge Field, will receive bids until April 20 for construction of a forge and wheelwright shop here.

Mo., St. Louis—City Foundry Co., Ninth St. and Park Ave., plans re-construction of foundry building destroyed by fire. $45,000 including equipment.

N. J., Jersey City—J. Goldenberg, 80 Woodland Ave., Englewood, revised preliminary plans prepared for construction of a 4 story garage and showrooms at Sip and Summit Aves. here. Estimated cost $150,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt. Noted February 4.

N. J., Newark—Alling Corp., 33 Ward St., having new preliminary plans prepared for construction of a 1 story garage at 36-42 Columbia St. Estimated cost $42,000. William E. Lehman, 972 Broad St., Archt. U. S. Post Office Department, Washington, D. C., lessee. Noted March 24.

N. J., North Bergen—Owner, c/o McDermott & Binda, 582 Bergenline Ave., Union City, Archts., having sketches made for a 1 story shop building at Van Wagenen Pl. here. Estimated cost $40,000.

N. J., South Amboy—Titanium Pigment Co., W. F. Meredith, 60 John St., New York, N. Y., plans construction of a plant, machine shop, etc., here. Estimated cost $1,000,000.

N. Y., Brooklyn—Albemarle Heights Building Corp., 63 Church Ave., having sketches made for construction of a service garage and gas station at 705 Gravesend Ave. Estimated cost $100,000. B. Driesler, Jr., 153 Remsen St., Archt.

N. Y., Brooklyn—F. H. Bookhop Co., 451 38th St., manufacturers of brooms and brushes, having sketches made for 2 story, 25 x 96 ft. garage and storage building at 38th St. and West 5th Ave. M. Klein, 65 Court St., Archt.

N. Y., Brooklyn—M. Friedman, 236 Montgomery St., having sketches made for 1 story, 100 x 120 ft. service garage at Utica Ave. and Winthrop St. S. L. Malkind, 93 Court St., Archt.

N. Y., Brooklyn—I. Harms, 277 Moffat St., having sketches made for a 1 story, 100 x 100 ft. service garage and gas station at Moffat St. and Knickerbocker Ave. G. I. Prowler, 367 Fulton St., Archt.

N. Y., Brooklyn—L. Schwartz, 634 Elton St., having sketches made for construction of a 1 story, 60 x 100 ft. service garage at Ashford St. and New Lots Ave. I. Kirshenbilt, 1125 Eastern Parkway, Archt.

N. Y., Brooklyn—Todd Dry Dock Engineering & Repair Co., ft. of 23rd St., considering plans for improving and extending plant including drydock, repair shop, etc. Estimated cost to exceed $40,000. Maturity soon.

N. Y., New York—Consolidated Gas Co., 4 Irving Pl., will build a 6 story addition to shop and storage building, etc., at 120 Amsterdam Ave. J. F. Hunter, 4 Irving Pl., Archt. Work will be done by day labor. Noted March 24.

O., Cleveland—C. Aronson, 2509 East 35th St., plans construction of a 1 story, 38 x 90 ft. addition to be used as copper working shop.

O., Fairfield—Constructing Quartermaster, Wright Field, Dayton, plans to expend $246,000 for expansion program at Fairfield Air depot here to include hangars, repair shops, etc.

Pa., Brockway—Brockway Machine Bottle Co., will soon award contract for a 35 x 100 ft. addition to plant. R. G. Howard, National Bank Bldg., Du Bois, Archt.

Pa., Philadelphia — George A. Fuller Co., Morris Bldg., Gen. Contrs., receiving bids on separate contracts for garage building for Franklin Savings Fund, c/o Gen. Contrs.

R. I., Newport—H. L. Rooney, 116 Bellevue Ave., will soon award contract for construction of a 1 story, 78 x 112 ft. automobile service station at Casino Terrace. Estimated cost $40,000. Edward M. Corbett, 49 Purchase St., Fall River, Mass., Archt. Bids April 7. Noted March 10.

Tenn., Memphis—D. Shea Boiler Works, 1106 Kansas St., plans to rebuild plant destroyed by fire. $55,000.

Va., Alexandria — Ford Motor Co., Schafer Road, Dearborn, Mich., will soon award general contract for construction of a 1 story assembly plant including distribution and service building, enameling department, loading dock, etc., here. Estimated cost $1,000,000. Contract awarded for structural steel. Noted February 18.

Wash., Seattle—Washington Iron Works, Airport Way, plans to rebuild plant destroyed by fire. $70,000 including equipment.

Mann., Winnipeg—Fort Garry Tire & Service, Ltd., 205 Fort St., awarded contract for construction of a 1 story, 50 x 75 ft. garage at Fort and St. Marys Sts. $10,000.

Ont., Toronto — City awarded sub-contracts for a 2 story motor vehicle repair shop on Strachan Ave. Estimated cost $210,987. J. J. Woolnaugh, City Hall, is architect, and Craig & Madill, 96 Bloor St. W., Consit. Archts.

Ont., Toronto—Radio Condenser Co., Camden, N. J., plans construction of building or leasing and equipping plant for radio condenser manufacturing. $40,000.

Que., Montreal—Lighting Appliance Inc., 9 Desbrosses St., New York, N. Y., manufacturers of residential lighting fixtures, etc., has leased old Dominion Rubber Co. plant here and will install equipment for enameling and plating plant. Noted March 10.

United Soviet Socialist Russia—c/o Amtorg Trading Corp., 261 5th Ave., New York, N. Y., plans vocational school program including one hundred six new schools, students living quarters, etc., at various locations. Estimated total cost $11,600,000.

Equipment Wanted

Calif., San Diego—Bureau of Supplies & Accounts, Navy Department, Washington, D. C., will receive bids until April 12 for three lathe chucks for Navy Yard here. Sched. 7751.

D. C., Washington—Bureau of Supplies & Accounts, Navy Department—will receive bids until April 19 for three engine lathes and spares for motor driven milling machines and four power hack saws and spare brushes, 28 in. drills, crank shapers, grinders and sensitive drills, all motor driven, for Navy Yards, Brooklyn, Philadelphia, Mare Island and Puget Sound. Schs. 7766, 7765, 7761, 7764, 7763, 7762 and 7760.

D. C., Washington — Procurement Division, Veterans' Administration—will receive bids until April 11 for one universal portable saw with stand. Cir. 459-M.

Me., Valley Park—Barbour Boat Works—lathe chuck, 3-jaw, 6 to 10 in.